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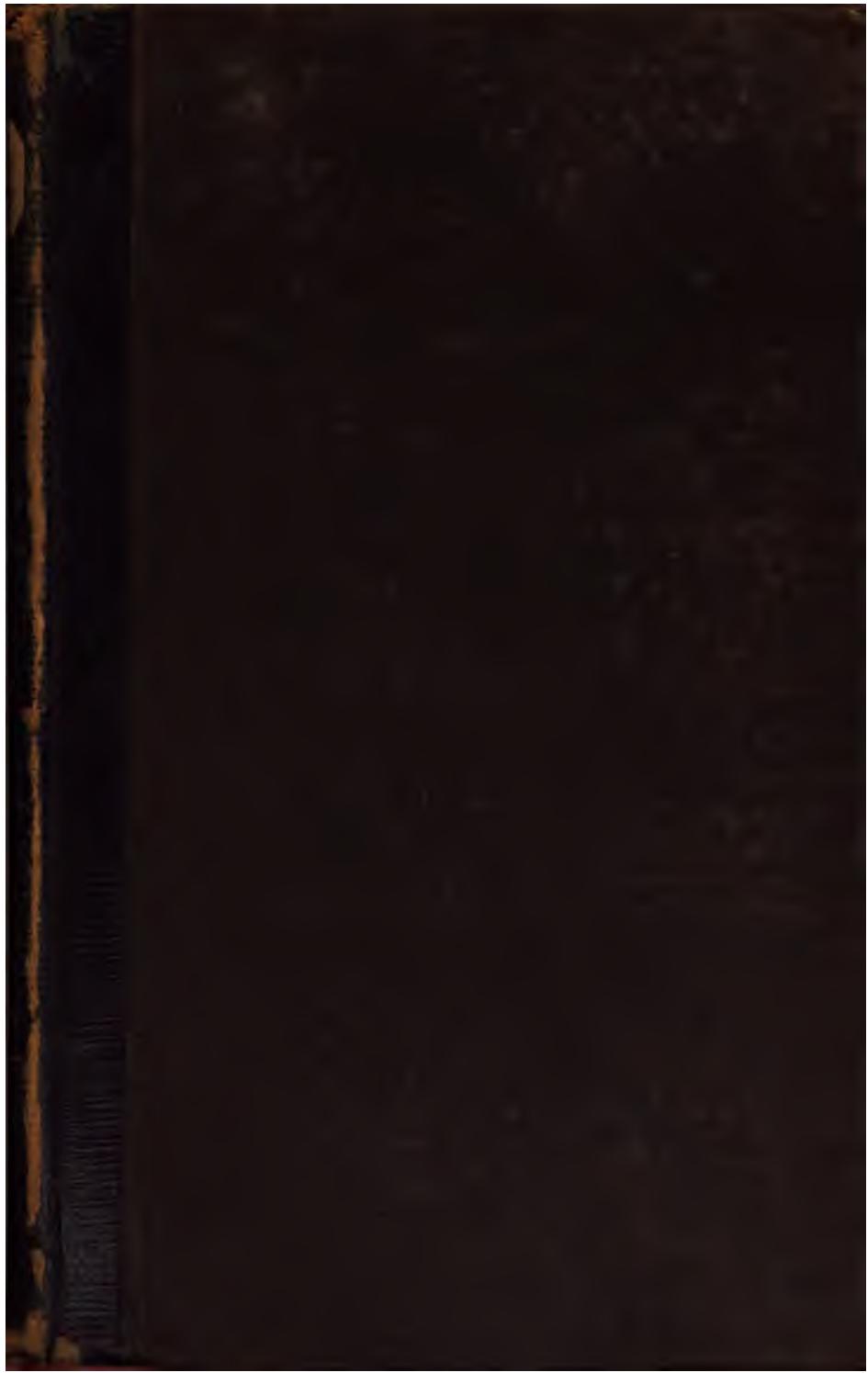
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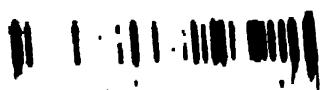
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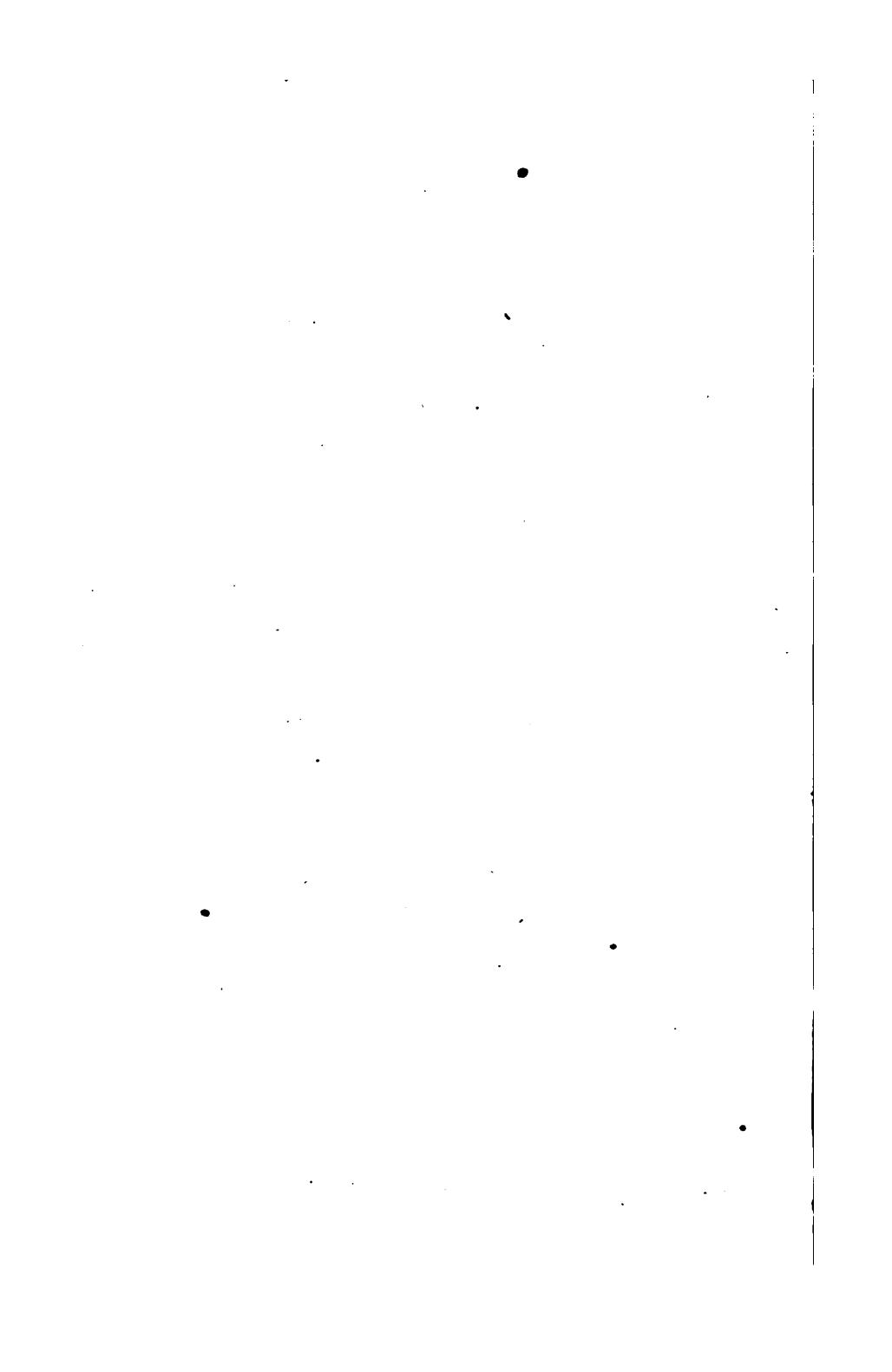
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P. L. Cassel,

March, 1869.

A

K E Y

TO THE

NATIONAL ARITHMETIC,

EXHIBITING THE OPERATION OF
THE MORE DIFFICULT QUESTIONS
IN THAT WORK;
FOR THE USE OF TEACHERS ONLY.

By BENJAMIN GREENLEAF, A. M.,
PRINCIPAL OF BRADFORD TEACHERS' SEMINARY.

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1850.

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P R E F A C E.

THE object of the author, in this publication, is to aid the teacher in communicating his instructions to his pupils, and enable him the more readily to detect any error which they may have made in the operation of their questions.

Every instructor, who has a large number of scholars under his care, is aware that it is a great tax on his time, especially when in school, to examine the operation of many questions of his students ; whereas, by the aid of a Key, he may be able, in a few moments, to detect any mistake in the operation. Besides, in the hurry of business, it is often very difficult for the most able arithmetician to recollect, at the moment, all the principles by which some difficult questions are performed ; but, by recurring to a Key, his difficulty will be obviated.

The author would recommend the following maxim to every teacher :— Never give a pupil a *direct* answer to any question he may propose respecting the solution of a problem, nor perform the labor for him, but suggest such principles as will enable him to perform the question himself.

The answers to all the questions are inserted in the Key, mainly for the accommodation of those teachers who may prefer to use copies of the Arithmetic in which the answers are not contained.

B. GREENLEAF.

Bradford, February 28, 1848.

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K E Y

TO

GREENLEAF'S ARITHMETIC.

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NUMERATION.

1. (p. 17.)	29
2.	407
3.	23,007
4.	5,000,027
5.	7,205,005
6.	2,207,604,009
7.	105,909,308,201
8.	9,000,000,008,000,000,046
9.	15,000,000,000,031,000,017
10.	507,000,000,000,000,203,057,000,018
11.	9,000,000,000,000,047,007,002,000,397
12.	15,000,000,000,000,000,000,000,010,127,026,320,426

NOTE. — The above is the French method.

SECTION II.

ADDITION.

21. (p. 19.)	30530	26.	29340	31.	276605
22.	31643	27.	283649	32.	3980839
23.	26798	28.	300000	33.	4183478
24.	28578	29.	264088	34.	31881050
25.	34383	30.	357477	35.	3837156

1*

36.	4801393	42.	118106	48.	119
37.	5067696	43.	1386486	49.	\$ 228
38.	5640426	44.	65951058	50.	\$ 37443
39.	4344737	45.	62075	51.	94989
40.	4935497	46.	11087	52.	282
41.	1937678	47.	8 82871	53.	17068666

SECTION III.

SUBTRACTION.

7. (p. 22.)	5676	30.	
8.	5119	31.	6686136
9.	4409	32.	760702380
10.	2589	33.	31309891
11.	48447	34.	16680605
12.	46698	35.	10014098379
13.	17672	36.	84892699
14.	53859	37.	466426
15.	411001	38.	85748033
16.	426944	39.	1011112
17.	6202102	40.	7152877
18.	799081	41.	8806665
19.	1439	42.	1302440
20.	92690	43.	3671616
21.	243334	44.	85
22.	617441	45.	111
23.	900981	46.	190
24.	98999080	47.	993044
25.	788889	48.	\$ 11810
26.	9393239896461	49.	\$ 14
27.	408881883715	50.	
28.	61475423	51.	173
29.	999999	52.	1026

SECTION IV.

MULTIPLICATION.

5. (p. 27.)	3156492	42.	204060808060402
6.	6172835	43.	700000000
7.	1979796	44.	7207272072
8.	30316704	45.	63126063000
16.	5433285969	46.	3394240201606
17.	274091971580	47.	169233130080
18.	217120000000	48.	915527086788307
19.	5745151000000	49.	454115186861492
20.	3545304	50.	12032109124168023
21.	584720181340	51.	81000108000036
22.	594731545000	53.	\$ 945
23.	1191090948350	54.	\$ 26645
24.	406781410014	55.	\$ 5529
25.	318697622634	56.	\$ 2779
26.	2308964672470	57.	\$ 21053
27.	222170629035000	58.	13505 miles.
28.	78043410604000	59.	480 sheets.
29.	137260338494	60.	24336 miles.
30.	121982631112635269	61.	\$ 4886
31.	213255462816	62.	4888 cts.
32.	4814703649710	63.	9021 cts.
33.	2650726049700	64.	59784 men.
34.	395018272	65.	4552 cts.
35.	9594000000	66.	6975 cts.
36.	70126114040	67.	246018 yards.
37.	162068556600	68.	2784 squares.
38.	5427563769000	69.	12213663 pounds.
39.	475065601536	70.	29657416470704
40.	8794170000	71.	\$ 50151
41.	70000000		

SECTION V.

SHORT DIVISION.

	Quotients.	Rem.		Quotients.	Rem.
4. (p. 31.)	16464392	4	16.	23762387	2
5.	1810157	2	17.	20166474	1
6.	4180695	7	18.	17964186	4
7.	137174	1	19.	33081425	3
8.	17898	5	20.	13698246	4
9.	151617	2	21.	26316692	1
10.	763988		22.	169739167	3
11.	33946768		23.	133557795	1
12.	105596437		24.	129629629	3
13.	141973831	2	25.	129684126	6
14.	24691357	4	26.	124999999	7
15.	111946492	1	27.	14285714	2

LONG DIVISION.

CASE I.

	Quotients.	Rem.		Quotients.	Rem.
5. (p. 34.)	193051		20.	12812	21208
6.	17166		21.	29959	2318
7.	153227	44	22.	1000	1000
8.	275175		23.	1620	1279
9.	17327		24.	859	2167762
10.	69255		25.	512	77475
11.	71451		26.	987654321	
12.	8650	111	27.	7060504	4267
13.	90365	28	28.	6017853	2355
14.	4598	297	29.	5000700	1234
15.	226447	174	30.	88888	2341
16.	5091	5091	31.	123000	4321
17.	2149	16919	32.	4001100	6789
18.	1728	43679	33.	6716700	7896
19.	10924	52765	34.	987648	8967

	Quotients.	Rem.		Quotients.	Rem.
35.	18711000	278	41.	4807658	6785
36.	10000	6876	42.	16789001	7856
37.	101010101	2345	43.	304050607	8567
38.	70000	3456	44.	908007004	8765
39.	800008	4567	45.	2003007001	1357
40.	900900	5678			

CASE II.

2. (p. 36.)	5	2100	5.	3	137851
3.	19	127810	6.	11	91853
4.	8	1145678	7.	37	411111

CASE III.

1.	12345678	9	3.	122112347	800
2.	9876543	21	4.	89765	432156

CASE IV.

3. (p. 37.)	320	11	7.	138	45
4.	308	1	8.	273	18
5.	38	38	9	1196	45
6.	507	40			

SECTION VI.

CONTRACTIONS IN MULTIPLICATION.

CASE I.

2. (p. 37.)	246913575	|	3.	1177768025
-------------	-----------	--	----	------------

CASE II.

5. (p. 38.)	2222233100	|	6.	411224100
-------------	------------	--	----	-----------

CASE IV.

9.	77769992223	|	12.	108548794035
10.	5554994445	|	14.	2304519769548

SECTION VII.
CONTRACTIONS IN DIVISION.

CASE IV.

$$5. \text{ (p. 40.) } 70294\overline{3}13 | 6. \quad \quad \quad 9876\overline{5}36$$

CASE V.

$$8. \text{ (p. 41.) } 75432 | 9. \quad \quad \quad 789563$$

CASE VI.

$$11. \quad 12345 \quad | \quad 12. \quad 98765 \quad | \quad 13. \quad 9123456789$$

SECTION VIII.

MISCELLANEOUS EXAMPLES.

1. (p. 41.) $1705536 \div 1728 = 987$ Ans.
2. $175686 \div 987 = 178$ lbs. Ans.
3. $697800 \div 100 = \$6978$ Ans
4. $111680 \div 16 = 6980$ lbs. Ans.
5. $5868 \div 6 = \$978$ Ans.
6. $\$25,000 \div 12 = \$2083\frac{1}{2}$ Ans.
7. $\$96 \div 8 = \12 Ans.
8. $30 \div 6 = 5$ hours, Ans.
9. $\$8395 \div 365 = \23 Ans.
10. $25,000 \div 65 = 384\frac{8}{13}$ hours, Ans.
11. $\$405 + \$15 = 27$ cwt. Ans.
12. $6789560 \div 20 = 339478\frac{1}{2}$ £. Ans.
13. $31,173 + 365 = 854\frac{1}{8}$ verses, Ans.
14. $123456720 \div 60 = 2057612$ hours, Ans.
15. $\$66,144 \div 4 = \$16,536$; $\$66,144 - \$16,536 = \$49,608$; $\$49,608 \div 4 = \$12,402$ Ans.
16. $175 \times \$87 = \$15,225$; $\$1234 + \$197 = \$1431$; $\$15,225 - \$1431 = \$13,794$; $\$13,794 \div 22 = \627 for a gentleman, Ans.; $\$627 \times 2 = \1254 for a lady, Ans.
17. $1086240 \div 160 = 6789$ acres, Ans.
18. $14222160 \div 144 = 98765$ feet, Ans.

19. $2 + 8 = 10$; $10 \times 4 = 40$; $40 + 32 = 72$; $72 + 2 = 36$; $36 \times 10 = 360$; $360 \div 24 = 15$ Ans.

20. $12 \times 12 \times 6 = 864$; $6 \times 12 = 72$; $864 - 72 = 792$ Ans.

21. $\$7 \times 8 = \56 ; $\$8 \times 3 = \24 ; $\$56 + \$24 = \$80$ Ans.

22. $\$75 + \$87 + \$31 = \193 ; $\$38 + \$12 = \$50$; $\$193 - \$50 = \$143$ Ans.

23. $\$85 \div \$5 = 17$ cords, Ans.

24. $127 \times \$47 = \5969 ; $212 \times \$96 = \$20,352$; $212 + 127 = 339$; $500 - 339 = 161$; $161 \times \$37 = \5957 ; $\$20,352 + \$5969 + \$5957 = \$32,278$; $\$32,278 - \$17,876 = \$14,402$ Ans.

25. $938 \div 7 = 134$ cloaks, Ans.

26. $97 \times \$5 = \485 ; $97 - 17 = 80$; $80 \times \$8 = \640 ; $\$640 - \$485 = \$155$ gain, Ans.

27. $671 \times 12 = 8052$ pence, Ans.

28. $5280 \times 12 = 63360$ inches, Ans.

29. $1728 \times 16 = 27648$ ounces, Ans.

30. $8136 \div 12 = 678$ shillings, Ans.

31. $3787 \times 1728 = 6543936$ inches, Ans.

SECTION X.

COMPOUND ADDITION.

- | | |
|--|--|
| 2. (p. 51.) $\$177.66, 3.$ | 16. 2513E.E. 3qr. 2na. 0in. |
| 3. $\$2877.87, 2.$ | 18. 317A. OR. 24p. $13\frac{3}{4}$ ft. |
| 5. 141£. 10s. $7\frac{3}{4}$ d. | 20. 378 cords 96ft. 1460in. |
| 6. 161£. 17s. 7d. | 22. 286hhd. 42gal. 1qt. 1pt. |
| 8. 385lb. 7oz. 5dwt. 10gr. | 24. 784hhd. 24gal. 2qt. 0pt. |
| 10. 246lb 10 $\frac{3}{4}$ 33 2D 2gr. | 26. 240ch. 20bu. 2pk. 7qt. |
| 12. 233cwt. 1qr. 6lb. 4oz. 5dr. | 28. 212y. 11mo. 29d. 4h. |
| 14. 317m. 3fur. 18rd. 4yd. 2ft.
6in. 0br. | 30. 11S. 2° 22' 42". |
| | 32. 194m. 6fur. 9ch. 0p. 12l. |

SECTION XI.

COMPOUND SUBTRACTION.

- | | |
|---|--|
| 2. (p. 55.) \$ 491.72, 9. | 18. 163 cords 53ft. 1289in. |
| 4. 435£. 15s. 9 $\frac{1}{4}$ d. | 20. 6hhd. 61gal. 2qt. 1pt. |
| 6. 38lb. 7oz. 14dwt. 13gr. | 22. 577hhd. 52gal. 2qt. |
| 8. 5lb 5 $\frac{1}{2}$ 0 3 1 $\frac{1}{2}$ 17gr. | 24. 26ch. 22bu. 2pk. 4qt. |
| 10. 53cwt. 3qr. 23lb. 14oz. | 26. 28y. 11mo. 2w. 4d. 21h.
48m. 35s. |
| 12. 31E.E. 4qr. 2na. | 28. 2S. 27° 21' 54". |
| 14. 9deg. 4m. 5fur. 37rd. 4yd.
1ft. 4in. 1bar. | 30. 12m. 6fur. 8ch. 0p. 24l. |
| 16. 3A. 1R. 38p. 18yd. 7ft.
34in. | |

EXERCISES IN COMPOUND ADDITION AND SUBTRACTION.

1. (p. 58.) 131£. 5s. 8 $\frac{1}{4}$ d.
 2. 20£. 17s. 10d.
 3. 5lb. 9oz. 4dwt. 20gr.
 4. 7lb 10 $\frac{1}{2}$ 3 5 1 $\frac{1}{2}$ 4gr.
 5. 63lb 4 $\frac{1}{2}$ 7 3 2 $\frac{1}{2}$ 19gr.
 6. 117cwt. 1qr. 19lb.
 7. 175yd. 2qr. 2na.

m.	fur.	rd.	yd.	ft.	in.
371	3	37	5	2	10
289	2	18	3	1	9
399	7	0	0	3	11
1060	5	16	4 $\frac{1}{2}$	2	6
			$\frac{1}{2} = 1$		6
1060	5	16	5	1	0

9. 588A. 1R. 31p.
 10. 7S. 29° 33' 56".

11. 82 cords 115ft. 487in.
 12. 276hhd. 48gal. 1qt.

y.	mo.	w.	d.	h.	m.	s.
14	3	2	5	0	0	0
9	10	3	4	23	12	15
2	1	3	2	0	7	0
26	3	1	4	23	19	15
4	5	3	0	0	47	45

14. 67A. 0R. 38p. 265 $\frac{1}{2}$ ft.
 15. 99£. 16s. 5 $\frac{1}{4}$ d.

m.	fur.	rd.	ft.	in.
25,000	0	0	0	0
43	0	17	0	9
24,956	7	22	15 $\frac{1}{2}$	3
			$\frac{1}{2} = 6$	
24,956	7	22	15	9

17. 4 cords 50ft. 0in.
18. 11yd. 1qr. 3na.

19. 33cwt. 2qr. 23lb.
20. 54gal. 0qt. 1pt.

A.	R.	P.
10	3	10
1	2	13
2	2	5
4	0	18
6	2	32

°	"	"	"
13	10	35	00
59	8	20	

22. 86bu. 1pk. 0qt. 1pt.

24. 1T. 19ft. 1418in.

25.				
lb	5	3	0	gr.
1	0	0	0	0
4	2	0	13	
3	1	2	14	
7	4	0	7	
4	3	2	13	

26.				
bbl.	gal.	qt.	pt.	
18	3	2	0	
18	0	0	1	
31	3	2	1	
5	3	1	1	

27.		
\$	cts.	m.
100	00	0
17	28	5
10	00	5
37	15	0
64	44	0
35	56	

SECTION XII.

REDUCTION DESCENDING.

2. (p. 61.) $127 \times 20 + 15 = 2555 \times 12 + 8 = 30668$
 $\times 4 = 122672$ Ans.
3. $28 \times 20 + 19 = 579 \times 12 + 11 = 6959 \times 4 + 3 =$
 27839 Ans.
4. $378 \times 20 = 7560 \times 12 = 90720$ Ans.
5. $28 \times 12 + 11 = 347 \times 20 + 12 = 6952 \times 24 + 15$
 $= 166863$ Ans.
6. $17 \times 12 = 204 \times 20 + 12 = 4092$ Ans.
7. $3 \times 12 + 11 = 47 \times 20 = 940 \times 24 = 22560$ Ans.
8. $23 \times 12 = 276 \times 8 = 2208 \times 3 = 6624$ Ans.

9. $3 \times 20 + 16 = 76 \times 4 + 2 = 306 \times 28 + 18 = 8586 \times 16 = 137376$ Ans.
10. $2 \times 20 + 17 = 57 \times 4 + 3 = 231 \times 28 + 16 = 6484 \times 16 + 15 = 103759 \times 16 + 13 = 1660157$ Ans.
11. $57 \times 4 = 228 \times 4 = 912$ Ans.
12. $83947 \times 5 + 4 = 419739 \times 4 = 1678956$ Ans.
13. $2263 \times 3 + 2 = 6791$ Ans.
14. $79 \times 8 = 632 \times 40 = 25280 \times 16\frac{1}{2} = 417120$ Ans.
15. $396 \times 40 = 15840 \times 16\frac{1}{2} = 261360 \times 12 = 3136320$ Ans.
16. $30 \times 8 = 240 \times 40 = 9600 \times 16\frac{1}{2} = 158400 \times 12 = 1900800$ Ans.
17. $360 \times 69\frac{1}{2} = 25020 \times 8 = 200160 \times 40 = 8006400 \times 16\frac{1}{2} = 132105600 \times 12 = 1585267200 \times 3 = 4755801600$ Ans.
18. $403 \times 8 + 7 = 3231 \times 40 + 35 = 129275 \times 5\frac{1}{2} + 2 = 711014\frac{1}{2} \times 3 = 2133043\frac{1}{2} \times 12 = 25596522 \times 3 + 1 = 76789567$ Ans.
19. $413 \times 3 + 2 = 1241 \times 8 + 2 = 9930 \times 40 + 38 = 397238 \times 5\frac{1}{2} + 1 = 2184810 \times 3 = 6554430 \times 12 + 1 = 78653167$ Ans.
20. $144 \times 8 + 1 = 1153 \times 40 + 8 = 46128 \times 5\frac{1}{2} + 1 = 253705 \times 3 + 1 = 761116$ Ans.
21. $1051 \times 3 + 2 = 3155 \times 12 + 5 = 37865$ Ans.
22. $3576 \times 40 + 12 = 143052 \times 5\frac{1}{2} + 3 = 786789$ Ans.
23. $25 \times 160 = 4000 \times 272\frac{1}{4} = 1089000$ Ans.
24. $365 \times 640 = 233600 \times 160 = 37376000$ Ans.
25. $196563942 \times 640 = 125800922880 \times 160 = 20128147660900 \times 272\frac{1}{4} = 5479888200652800 \times 144 = 789,103,900,894,003,200$ Ans.
26. $10 \times 4 + 3 = 43 \times 40 + 38 = 1758 \times 30\frac{1}{4} + 6 = 53185\frac{1}{2} \times 9 + 5 = 478674\frac{1}{2} + 72\text{in. or } \frac{1}{2}\text{ft.} = 478675$ Ans.
27. $2 \times 40 = 80 \times 30\frac{1}{4} + 24 = 2444 \times 9 + 3 = 21999 \times 144 = 3167856$ Ans.

28. $1 \times 4 + 3 = 7 \times 40 + 34 = 314 \times 30\frac{1}{4} + 27 =$
 $9525\frac{1}{4} \times 9 + 4 = 85733\frac{1}{4} \times 144 + 54 = 12345678$ Ans.
29. $17 \times 128 = 2176 \times 1728 = 3760128$ Ans.
30. $19 \times 40 = 760 \times 1728 = 1313280$ Ans.
31. $128 \times 128 = 16384$ Ans.
32. $4899 \times 63 + 4 = 308641 \times 4 + 3 = 1234567$
Ans.
33. $1224 \times 2 + 1 = 2449 \times 2 + 1 = 4899 \times 63 + 19$
 $= 308656 \times 4 + 1 = 1234625 \times 2 = 2469250 \times 4 + 1 =$
 9877001 Ans.
34. $790 \times 2 = 1580 \times 63 + 58 = 99598 \times 4 = 398392$
 $\times 2 + 1 = 796785$ Ans.
35. $460 \times 2 + 1 = 921 \times 54 + 31 = 49765$ Ans.
36. $36 \times 54 + 26 = 1970 \times 4 + 3 = 7883 \times 2 + 1 =$
15767 Ans.
37. $16 \times 40 = 640 \times 1728 = 1105920$ Ans.
38. $365\frac{1}{4} \times 24 = 8766 \times 60 = 525960 \times 60 = 31557600;$
 $2348 + 1835 = 4183 \times 31557600 = 132005440800$ Ans.
39. June 13 + July 31 + August 31 + September 30
+ October 31 + November 30 + December 31 + January
31 + February 16 + 365 + 365 = 974 days, Ans.
40. $676 \times 36 = 24336 \times 4 = 97344$ pecks, Ans.
41. $657 \times 10 = 6570$ mills, Ans.
42. $3165 \times 100 = 316500$ mills, Ans.
43. $63 \times 100 = 6300$ cents, Ans.
44. $27 \times 10 \times 100 \times 10 = 270000$ mills, Ans.

REDUCTION ASCENDING.

2. (p. 63.) $122672 \div 4 = 30668\text{d.} \div 12 = 2555\text{s. 8d.}$
 $\div 20 = 127\text{\AA. 15s. 8d.}$ Ans.
3. $27839 \div 4 = 6959\frac{3}{4}\text{d.} \div 12 = 579\text{s. 11d.} \div 20 =$
 $28\text{\AA. 19s. }11\frac{3}{4}\text{d.}$ Ans.
4. $90720 \div 12 = 7560\text{s.} \div 20 = 378\text{\AA.}$ Ans.

5. $166863 \div 24 = 6952\text{dwt. } 15\text{gr.} \div 20 = 347\text{oz.}$
 $12\text{dwt.} \div 12 = 28\text{lb. } 11\text{oz. } 12\text{dwt. } 15\text{gr. Ans.}$
6. $4092\text{dwt.} \div 20 = 204\text{oz. } 12\text{dwt.} \div 12 = 17\text{lb. } 0\text{oz.}$
 12dwt. Ans.
7. $22560 \div 24 = 940\text{dwt.} \div 20 = 47\text{oz.} \div 12 = 3\text{lb.}$
 11oz. Ans.
8. $6624 \div 3 = 22083. \div 9 = 276\frac{5}{9} \div 12 = 23\text{lb. Ans.}$
9. $137376 \div 16 = 8586\text{lb.} \div 28 = 306\text{qr. } 18\text{lb.} \div 4$
 $= 76\text{cwt. } 2\text{qr.} \div 20 = 3\text{ tons, } 16\text{cwt. } 2\text{qr. } 18\text{lb. Ans.}$
10. $1660157 \div 16 = 103759\text{oz. } 13\text{dr.} \div 16 = 6484\text{lb.}$
 $15\text{oz.} \div 28 = 231\text{qr. } 16\text{lb.} \div 4 = 57\text{cwt. } 3\text{qr.} \div 20 = 2\text{T.}$
 $17\text{cwt. } 3\text{qr. } 16\text{lb. } 15\text{oz. } 13\text{dr. Ans.}$
11. $912 \div 4 = 228\text{qr.} \div 4 = 57\text{yd. Ans.}$
12. $1678956 \div 4 = 419739\text{qr.} \div 5 = 83947\text{EE. } 4\text{qr.}$
Ans.
13. $6791 \div 3 = 2263\text{EF. } 2\text{qr. Ans.}$
14. $417120 \div 16\frac{1}{2} = 25280\text{rd.} \div 40 = 632\text{fur.} \div 8 =$
 79m. Ans.
15. $3136320 \div 12 = 261360\text{ft.} \div 16\frac{1}{2} = 15840\text{rd.} \div 40$
 $= 396\text{fur. Ans.}$
16. $1900800 \div 12 = 158400\text{ft.} \div 16\frac{1}{2} = 9600\text{rd.} \div 40$
 $= 240\text{fur.} \div 8 = 30\text{m. Ans.}$
17. $4755801600 \div 3 = 1585267200\text{in.} \div 12 = 132105600\text{ft.}$
 $\div 16\frac{1}{2} = 8006400\text{rd.} \div 40 = 200160\text{fur.} \div 8 = 25020\text{m.}$
 $\div 69\frac{1}{2} = 360\text{deg. Ans.}$
18. $76789567 \div 3 = 25596522\text{in. } 1\text{br.} \div 12 = 2133043\text{ft.}$
 $6\text{in.} \div 3 = 711014\text{yd. } 1\text{ft.} \div 5\frac{1}{2} = 129275\text{rd. } 1\frac{1}{2}\text{yd.} \div 40 =$
 $3231\text{fur. } 35\text{rd.} \div 8 =$
 $403\text{m. } 7\text{fur. } 35\text{rd. } 1\frac{1}{2}\text{yd. } 1\text{ft. } 6\text{in. } 1\text{br.}$
 $\frac{1}{2}\text{yd.} = 1\text{ft. } 6\text{in. } 0\text{br.}$
-
- 403m. 7fur. 35rd. 2yd. 0ft. 0in. 1br. Ans.
19. $78653167 \div 12 = 6554430\text{ft. } 7\text{in.} \div 3 = 2184810\text{yd.}$
 $\div 5\frac{1}{2} = 397238\text{rd. } 1\text{yd.} \div 40 = 9930\text{fur. } 38\text{rd.} \div 8 = 1241\text{m.}$
 $2\text{fur.} \div 3 = 413\text{L. } 2\text{m. } 2\text{fur. } 38\text{rd. } 1\text{yd. } 0\text{ft. } 7\text{in. Ans.}$

20. $761116 \div 3 = 253705$ yd. 1 ft. $\div 5\frac{1}{2} = 46128$ rd. 1 yd.
 $\div 40 = 1153$ fur. 8 rd. $\div 8 = 144$ m. 1 fur. 8 rd. 1 yd. 1 ft. Ans.
21. $37865 \div 12 = 3155$ ft. 5 in. $\div 3 = 1051$ yd. 2 ft. Ans.
22. $786789 \div 5\frac{1}{2} = 143052$ rd. 3 yd. $\div 40 = 3576$ fur.
12 rd. 3 yd. Ans.
23. $1089000 \div 272\frac{1}{4} = 4000$ rd. $\div 160 = 25$ A. Ans.
24. $37376000 \div 160 = 233600$ A. $\div 640 = 365$ square miles, Ans.
25. $789,103,900,894,003,200 \div 144 = 5479888200652$.
800 ft. $\div 272\frac{1}{4} = 20128147660800$ rd. $\div 160 = 125800922880$ A.
 $\div 640 = 196563942$ square miles, Ans.
26. $478675 \div 9 = 53186$ yd. 1 ft. $\div 30\frac{1}{2} = 1758$ rd. $6\frac{1}{2}$ yd.
 $\div 40 = 43$ R. 38 rd. $\div 4 =$

$$\begin{array}{ll} 10 \text{A. } 3 \text{R. } 38 \text{rd. } 6\frac{1}{2} \text{yd. } & 1 \text{ft.} \\ & \frac{1}{2} \text{yd. } = 4 \text{ft. } 72 \text{in.} \end{array}$$

$$\begin{array}{ll} 10 \text{A. } 3 \text{R. } 38 \text{rd. } 6 \text{yd. } & 5 \text{ft. } 72 \text{in. } \text{Ans.} \end{array}$$

27. $3167856 \div 144 = 21999$ ft. $\div 9 = 2444$ yd. 3 ft. $\div 30\frac{1}{2} = 80$ rd. 24 yd. $\div 40 = 2$ R. 0 rd. 24 yd. 3 ft. Ans.
28. $12345678 \div 144 = 85733$ ft. 126 in. $\div 9 = 9525$ yd.
8 ft. $\div 30\frac{1}{2} = 314$ p. 26 $\frac{1}{2}$ yd. $\div 40 = 7$ R. 34 p. $\div 4 =$

$$\begin{array}{ll} 1 \text{A. } 3 \text{R. } 34 \text{p. } 26\frac{1}{2} \text{yd. } & 8 \text{ft. } 126 \text{in.} \\ & \frac{1}{2} \text{yd. } = 4 \text{ft. } 72 \text{in.} \end{array}$$

$$\begin{array}{ll} 1 \text{A. } 3 \text{R. } 34 \text{p. } 27 \text{yd. } & 4 \text{ft. } 54 \text{in. } \text{Ans.} \end{array}$$

29. $3760128 \div 1728 = 2176$ ft. $\div 128 = 17$ cords, Ans.
30. $1313280 \div 1728 = 760$ ft. $\div 40 = 19$ tons, Ans.
31. $16384 \div 128 = 128$ cords, Ans.
32. $1234567 \div 4 = 308641$ gal. 3 qt. $\div 63 = 4899$ hhd.
4 gal. 3 qt. Ans.
33. $9877001 \div 4 = 2469250$ pt. 1 gi. $\div 2 = 1234625$ qt.
 $\div 4 = 308656$ gal. 1 qt. $\div 63 = 4899$ hhd. 19 gal. $\div 2 =$
2449 pi. 1 hhd. $\div 2 = 1224$ T. 1 pi. 1 hhd. 19 gal. 1 qt. 0 pt. 1 gi.
Ans.
34. $796785 \div 2 = 398392$ qt. 1 pt. $\div 4 = 99598$ qt. $\div 63$

$= 1580\text{hhd. } 58\text{gal.} \div 2 = 790\text{pi. } 0\text{hhd. } 58\text{gal. } 0\text{qt. } 1\text{pt.}$
Ans.

35. $49765 \div 54 = 921\text{hhd. } 31\text{gal.} \div 2 = 460\text{ butts, } 1\text{hhd.}$
 31gal. Ans.

36. $15767 \div 2 = 7883\text{qt. } 1\text{pt.} \div 4 = 1970\text{gal. } 3\text{qt.} \div 54$
 $= 36\text{hhd. } 26\text{gal. } 3\text{qt. } 1\text{pt.}$ Ans.

37. $1105920 \div 1728 = 640\text{ft.} \div 40 = 16\text{ tons, }$ Ans.

38. $132005440800 \div 60 = 2200090680\text{m.} \div 60 =$
 $36668178\text{h.} \div 24 = 1527840\frac{3}{4}\text{ days,} \div 365\frac{1}{4} = 4183\text{ years.}$

39. $974 \div 365 = 2\text{ years, } 244\text{ days, }$ Ans.

40. $97344 \div 4 = 24336\text{bu.} \div 36 = 676\text{chald. }$ Ans.

41. $6570 \div 10 = 657\text{ cents, }$ Ans.

42. $316500 \div 100 = 3165\text{ dimes, }$ Ans.

43. $6300 \div 100 = \$63$ Ans.

44. $270000 \div 10 = 27000\text{ cts.} \div 100 = \$270 \div 10 =$
 27 Eag. Ans.

COMPOUND REDUCTION.

1. (p. 64.) $57\text{\pounds}. 15\text{s.} = 1155\text{s.} \div 6 = \$192.50.$

2. $67\text{\pounds}. 14\text{s. } 9\text{d.} = 16257\text{d.} ; 6\text{s. } 7\text{d.} = 79\text{d.} ; 16257 \div 79$
 $= 205\text{cr. } 62\text{d.} = 5\text{s. } 2\text{d.}$ Ans.

3. $\$678 \times 6 = 4068\text{s.} \div 20 = 203\text{\pounds}. 8\text{s.}$ Ans.

4. $761 \times 4 = 3044\text{qr.} \div 5 = 60\text{SEE. } 4\text{qr.}$ Ans.

5. $61 \times 3 = 183\text{qr.} \div 4 = 45\text{yd. } 3\text{qr.}$ Ans.

6. $63 \times 4 = 252 \times 2 = 504 \div 3 = 168\text{ bottles, }$ Ans.

7. $15 \times 1760 = 26400\text{yd.} \times 3 = 79200\text{ft.} \times 12 =$
 $950400\text{in.} ; 2\text{ft. } 8\text{in.} = 32\text{in. } 950400 \div 32 = 29700\text{ steps,}$
 Ans.

8. $2\text{oz. } 12\text{dwt.} = 52\text{dwt.} ; 5\text{lb. } 2\text{oz. } 8\text{dwt.} = 1248\text{dwt.}$

$\div 52 = 24\text{ spoons, }$ Ans.

9. $14\text{ft. } 9\text{in.} = 177\text{in.} ; 436 \times 1760 = 767360\text{yd.} \times 3$
 $= 2302080\text{ft.} \times 12 = 27624960\text{in.} ; 27624960 \div 177 =$
 $156073.\overline{38}\text{ times, }$ Ans.

10. $123 \times 78 = 9594$ hills, $\times 4 = 38376$ ears, $\div 8 = 4797$ qt. $\div 8 = 599$ pk. 5 qt. $\div 4 = 149$ bu. 3 pk. 5 qt. Ans.
11. 5yd. 2qr. 3na. = 91na.; 182yd. = 2912na. $\div 91 = 32$ suits, Ans.
12. 5dwt. 10gr. = 130gr.; 3lb. 1oz. 2dwt. 2gr. = 17810gr. $\div 130 = 137$ rings, Ans.
13. $18 \div 3 = 6 \times 4 = 24$ in.; $56 \times 60 \times 144 = 483840$ in.
 $\div 24 = 20160$ shingles, Ans.
14. $56 \times 25 \times 2 = 2800$ feet, $\times 6 = 16800$ shingles, Ans.
15. 22m. 3fur. 17rd. = 7177rd.; 25000m. = 8000000rd.
 $\div 7177 = 1114\frac{1}{12}$ days, Ans.
16. 7lb. 10oz. = 122oz.; 10cwt. 3qr. 16lb. = 19520oz.
 $\div 122 = 160$ weeks, Ans.
17. 3T. 17cwt. 3qr. 18lb. = 8726lb. $\times 7 = 61082$ d. = 254£. 10s. 2d. Ans.
18. 5cwt. 1qr. 10lb. = 598lb. $\times 4\frac{1}{2} = 2691$ d. = 11£. 4s. 3d. Ans.
19. $63 \times 4 \times 7 \times 9 = \158.76 Ans.
20. $54 \times 4 \times 2 \times 15 \times 3 = \194.40 Ans.
21. $73 \times 4 \times 8 = 2336$ qt. $\times 2 = \$46.72$ Ans.
22. $29 \times 57 = 1653$ yd. $\times 15 = \$247.95$ Ans.
23. 6cwt. 2qr. 11lb. + 5cwt. 3qr. 16lb. + 7cwt. 0qr. 7lb.
+ 3cwt. 1qr. 17lb. = 22cwt. 3qr. 23lb. = 2571lb. $\times 15 = \$385.65$ Ans.
24. 12cwt. = 1344lb.; 3cwt. 2qr. 11lb. + 4cwt. 1qr. 15lb. = 7cwt. 3qr. 26lb. = 894lb.; $1344 - 894 = 450$ lb. $\times 15 = \$67.50$ Ans.
25. 2cwt. 1qr. 7lb. + 3cwt. 2qr. 15lb. + 2cwt. 0qr. 20lb.
+ 5cwt. 3qr. 17lb. = 14cwt. 0qr. 3lb. = 1571lb. $\times 37\frac{1}{2} = \$589.12\frac{1}{2}$ Ans.
26. $87 \times 63 = 5481$ gal. $\times 33 = \$1808.73$ Ans.
27. 10gal. 1qt. 1pt. 3gi. = 335gi.; $63 \times 4 = 252$ qt. $\times 2 = 504$ pt. $\times 4 = 2016$ gi. — 335gi. = 1681gi. $\times 6 = \$100.86$ Ans.

28. 100A. 3R. 15p. + 161A. 2R. 28p. + 360A. 3R. 5p.
 $= 623A. 1R. 8p. ; 112A. 3R. 30p. + 316A. 1R. 18p. +$
 $168A. 3R. 13p. = 598A. 0R. 21p. ; 623A. 1R. 8p. - 598A.$
 $0R. 21p. = 25A. 0R. 27p. = 4027p. \times 1.35 = \$ 5436.45$ Ans.

29. 87gal. 1qt. - 13gal. = 74gal. 1qt. = 2376gi. $\times .01 =$
 $\$ 23.76$ Ans.

30. 25cwt. 0qr. 17lb. + 37cwt. 2qr. 17lb. + 18cwt. 3qr.
 $14lb. + 37cwt. 1qr. 17lb. = 119cwt. 0qr. 9lb. = 13337lb. \times$
 $.02 = \$ 266.74$ Ans.

REDUCTION OF THE OLD NEW ENGLAND CURRENCY TO UNITED STATES MONEY.

4. (p. 67.) 3) <u>315000</u> \$ 1050.00 Ans.	5. 3) <u>619000</u> \$ 2063.33½ Ans.	6. 3) <u>166000</u> \$ 553.33½ Ans.
7. 3) <u>318000</u> \$ 1060.00 Ans.	8. 3) <u>101000</u> \$ 336.66½ Ans.	9. 3) <u>144000</u> \$ 480.00 Ans.
10. 3) <u>161900</u> \$ 539.66½ Ans.	11. 3) <u>361850</u> \$ 1206.16½ Ans.	12. 3) <u>99550</u> \$ 331.83½ Ans.
13. 3) <u>100450</u> \$ 334.83½ Ans.	14. 3) <u>661350</u> \$ 2204.50 Ans.	15. 3) <u>47550</u> \$ 158.50 Ans.
16. 3) <u>109050</u> \$ 363.50 Ans.	17. 16850 26 <u>1</u> 3) <u>16877</u> \$ 56.25½ Ans.	18. 69050 13 <u>1</u> 3) <u>69064</u> \$ 230.21½ Ans.

SECT. XIII.] GREENLEAF'S ARITHMETIC. 21

19.	20.	21.
87800	14350	73150
44	30	18
2	1	1
<u>3)87846</u>	<u>3)14381</u>	<u>3)73169</u>
\$ 292.82 Ans.	\$ 47.93 $\frac{1}{4}$ Ans.	\$ 243.89 $\frac{1}{4}$ Ans.

22.	23.	24.
47600	187250	10000
40	3	13
2	<u>3)187253</u>	<u>3)10014</u>
<u>3)47642</u>	<u>\$ 624.17 $\frac{3}{4}$</u> Ans.	<u>\$ 33.38</u> Ans.
\$ 158.80 $\frac{3}{4}$ Ans.		

SECTION XIII.

UNITED STATES MONEY.

ADDITION.

1. (p. 68.)	\$ 1829.16,4.	5.	\$ 1717.06,2.
2.	\$ 328.72,2.	6.	\$ 154.35,5.
3.	\$ 1805.84,7.	7.	\$ 7.10,5.
4.	\$ 2320.67,5.		

SUBTRACTION.

1. (p. 69.)	\$ 781.24,3.	6.	\$ 13.87,5.
2.	\$ 278.48,6.	7.	\$ 909.75,0.
3.	\$ 69.06,6.	8.	\$ 3.43,0.
4.	\$ 154.06,9.	9.	\$ 2.36,0.
5.	\$ 2058.08,0.		

MULTIPLICATION.

3. (p. 70.)	\$ 16.38.		4.	\$ 58.59.
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KEY TO

[SECT. XIII.]

5.	\$ 591.25.	30.	\$ 272.16.
6.	\$ 3.35,8.	31.	\$ 424.58,8.
7.	\$ 249.28.	32.	\$ 119.34.
8.	\$ 1120.32.	33.	\$ 15.13.
9.	\$ 358.28.	34.	\$ 176.25.
10.	\$ 102.69.	35.	\$ 368.48.
11.	\$ 44.74,8.	36.	\$ 23.40.
12.	\$ 109.25.	37.	\$ 196.56.
13.	\$ 790.92.	38.	\$ 197.23.
14.	\$ 65.10.	39.	\$ 303.42.
15.	\$ 142.02.	40.	\$ 138.07,5.
16.	\$ 48.22,2.	41.	\$ 1106.77.
17.	\$ 48910.95.	42.	\$ 95.55.
18.	\$ 67.16.	43.	\$ 434.35.
19.	\$ 70.66,4.	44.	\$ 23.36.
20.	\$ 20.63,1.	45.	\$ 290.72.
21.	\$ 217.25.	46.	\$ 337.44.
22.	\$ 1133.99.	47.	\$ 3930.25.
23.	\$ 90.74,4.	48.	\$ 266.40.
24.	\$ 863.75.	49.	\$ 107.16.
25.	\$ 17.07,2.	50.	\$ 49.14.
26.	\$ 2023.56.	51.	\$ 46.50.
27.	\$ 454.61.	52.	\$ 57.80.
28.	\$ 10043.71,2.	53.	\$ 168.35.
29.	\$ 2610.67,2.	54.	\$ 26.12,5.

DIVISION.

2. (p. 73.)	\$ 0.95.	8.	\$ 20.00.
3.	\$ 0.12.	9.	\$ 4.25.
4.	\$ 0.75.	10.	\$ 1.75.
5.	\$ 2.75.	11.	\$ 0.06.
6.	\$ 0.75.	12.	\$ 3.75.
7.	\$ 4.00.	13.	\$ 2.28.

14.	\$ 3.89.	22.	\$ 1.62,5.
15.	\$ 1.25.	23.	\$ 0.67.
16.	\$ 1.19.	24.	\$ 5.68.
17.	\$ 4.68.	25.	\$ 1.62,5.
18.	\$ 0.18.	26.	\$ 37.75.
19.	\$ 132.55.	27.	\$ 6.79.
20.	\$ 1.12.	28.	\$ 69.74,8.
21.	\$ 5.63.		

BILLS.

1. (p. 74.)

$$\begin{aligned}
 \$0.45 \times 17 &= \$7.65 \\
 0.37 \times 19 &= 7.03 \\
 0.46 \times 16 &= 7.36 \\
 0.87 \times 13 &= 11.31 \\
 0.63 \times 9 &= 5.67 \\
 0.56 \times 25 &= 14.00 \\
 0.31 \times 17 &= 5.27 \\
 0.16 \times 19 &= \underline{3.04} \\
 &\quad \$61.33
 \end{aligned}$$

2.

$$\begin{aligned}
 \$0.98 \times 13 &= \$12.74 \\
 0.15 \times 16 &= 2.40 \\
 0.13 \times 38 &= 4.68 \\
 0.09 \times 47 &= 4.23 \\
 0.19 \times 12 &= 2.28 \\
 0.17 \times 7 &= 1.19 \\
 0.61 \times 13 &= \underline{7.93} \\
 &\quad \$35.45
 \end{aligned}$$

3.

$$\begin{aligned}
 \$5.25 \times 17 &= \$89.25 \\
 1.62 \times 29 &= 46.98 \\
 0.17 \times 60 &= 10.20 \\
 0.27 \times 49 &= 13.23 \\
 3.19 \times 18 &= 57.42 \\
 2.75 \times 27 &= 74.25 \\
 0.61 \times 75 &= 45.75 \\
 0.75 \times 36 &= 27.00 \\
 0.18 \times 49 &= \underline{8.82} \\
 &\quad \$372.90
 \end{aligned}$$

4.

$$\begin{aligned}
 \$2.75 \times 10 &= \$27.50 \\
 1.25 \times 19 &= 23.75 \\
 1.29 \times 83 &= 107.07 \\
 0.17 \times 47 &= 7.99 \\
 0.39 \times 91 &= 35.49 \\
 0.23 \times 47 &= 10.81 \\
 0.13 \times 68 &= 8.84 \\
 1.39 \times 27 &= \underline{37.53} \\
 &\quad \$258.98
 \end{aligned}$$

5.	
\$ 0.19 × 27 =	\$ 5.13
0.27 × 25 =	6.75
0.75 × 17 =	12.75
3.75 × 9 =	33.75
4.50 × 8 =	36.00
2.25 × 27 =	60.75
9.87 × 18 =	177.66
0.31 × 75 =	23.25
0.75 × 67 =	50.25
1.12 × 15 =	<u>16.80</u>
	\$ 423.09

7.	
\$ 4.50 × 7½ =	\$ 33.75
0.16 × 16½ =	2.68
0.25 × 18½ =	4.56½
0.17 × 30 =	5.10
0.19 × 3 =	0.57
0.18 × 7½ =	<u>1.35</u>
	\$ 48.01½

8.	
\$ 25.50 × 37 =	\$ 943.50
16.17 × 41 =	662.97
97.75 × 40 =	3910.00
169.37 × 13 =	<u>2201.81</u>
	\$ 7718.28

6.	
\$ 0.67 × 14 =	\$ 9.38
0.89 × 23 =	20.47
1.25 × 17 =	21.25
2.17 × 25 =	54.25
0.61 × 27 =	16.47
0.27 × 56 =	<u>15.12</u>
	\$ 136.94

9.	
\$ 6.25 × 97 =	\$ 606.25
5.95 × 167 =	993.65
6.07 × 87 =	528.09
5.75 × 196 =	1127.00
7.25 × 275 =	1993.75
1.16 × 69 =	80.04
0.67 × 136 =	91.12
0.76 × 68 =	51.68
1.37 × 169 =	231.53
9.67 × 76 =	784.92
69.70 × 89 =	6203.30
3.47 × 49 =	170.03
1.61 × 39 =	62.79
0.17 × 197 =	33.49
0.69 × 86 =	59.34
1.17 × 78 =	91.26
0.85 × 187 =	158.95
11.61 × 91 =	1056.51
17.15 × 83 =	1423.45
3.16 × 47 =	148.52
18.15 × 35 =	635.25
9.47 × 47 =	445.09
6.83 × 57 =	<u>389.31</u>
	\$ 17315.32

SECTION XIV.

COMPOUND MULTIPLICATION.

- | | |
|------------------------------------|--|
| 2. (p. 78.) 10£. 13s. 0d. | 21. 335yd. 2qr. 0na. 0½in. |
| 3. 10£. 0s. 4½d. | 22. 215m. 7fur. 1rd. 14ft. 6in. |
| 4. 3£. 2s. 4d. | 23. 149deg. 8m. 0fur. 0rd.
1yd. 1ft. 6in. |
| 5. 54yd. 2qr. 3na. | 24. 97deg. 55m. 7fur. 35rd.
4ft. 2in. 1bar. |
| 6. 29cwt. 3qr. 16lb. | 25. 181A. 3R. 11p. 6yd. 4ft.
4lin. |
| 7. 37T. 17cwt. 0qr. 16lb. | 26. 31 cords 83ft. 1332in. |
| 8. 76da. 11h. 53m. | 27. 209hhd. 55gal. 3qt. 0pt.
1gi. |
| 9. 75£. 6s. 6d. | 28. 85 tuns 3hhd. 4gal. 2qt. |
| 10. 124£. 13s. 10d. | 29. 56hhd. 45gal. |
| 11. 251£. 19s. 7½d. | 30. 118bu. 1pk. 5qt. |
| 12. 212£. 1s. 7½d. | 31. 255ch. 24bu. 3pk. 1qt. |
| 13. 653£. 18s. 0d. | 32. 110y. 343da. 3h. 41m.
12sec. |
| 14. 111£. 8s. 11d. | 33. 214A. 3R. 12p. |
| 15. 159£. 4s. 9d. | 34. 3da. 16h. 54m. |
| 16. 158lb. 9oz. 1dw. 21gr. | 35. 29 bushels. |
| 17. 111lb. 11oz. 17dw. 9gr. | |
| 18. 183T. 1cwt. 2qr. 11lb.
4oz. | |
| 19. 105T. 7cwt. 0qr. 6lb. 8oz. | |
| 20. 19lb 9¾ 43 2D 9gr. | |

$$\begin{array}{r}
 \text{37.} \\
 \text{£. s. d.} \\
 0 \ 3 \ 8 \\
 \underline{+ \quad 4} \\
 0 \ 14 \ 8 = \text{price of 4yd.}
 \end{array}$$

$$\begin{array}{r}
 \text{2} \ 18 \ 8 = \text{price of 16yd.}
 \end{array}$$

$$\begin{array}{r}
 \text{38.} \\
 \text{£. s. d.} \\
 0 \ 19 \ 11 \\
 \underline{+ \quad 8} \\
 7 \ 19 \ 4 = \text{price of 8yd.}
 \end{array}$$

$$\begin{array}{r}
 \text{71} \ 14 \ 0 = \text{price of 72yd.}
 \end{array}$$

39.
£ s. d.
0 1 11
7

0 13 5 = price of 7yd.
12
8 1 0 = price of 84yd.

40.
T. cwt. qr. lb.
0 12 2 11
9

5 13 1 15 = weight of 9hhd.
10
56 13 3 10 = weight of 90hhd.

41.
£ s. d. qr.
0 5 9 2
3

0 17 4 2 = price of 3 sheep.
6
5 4 3 0 = price of 18 sheep.

42.
£ s. d.
0 9 11
7

3 9 5 = price of 7yd.
3
10 8 3 = price of 21yd.

43.
£ s. d.
0 11 6
11

6 6 6 = price of 11 hats.
2
12 13 0 = price of 22 hats.

44.
£ s. d. qr.
13 8 9 2
12

161 5 6 0 = price of 12
8 [shares.
1290 4 0 0 = price of 96
[shares.

45.
lb. oz. dwt. gr.
0 3 5 15
12

3 3 7 12 = weight of 12 spoons.
10

46.
m. fur. rd.
24 7 4
5

124 3 20 = 5 days.
6

32 9 15 0 = weight of 120 spoons.

746 5 0 = 30 days.

47.
°
0 15
10
2 30 = 10 minutes.
6
15 0 = 60 minutes.

48.
A. B. P. yd. ft. in.
39 3 17 30 8 100
8
318 3 24 5 6 80
4
1275 2 16 22 8 32 Ans.

$$\begin{array}{r} \text{y.} \quad \text{d.} \quad \overset{49.}{\text{h.}} \quad \text{m.} \quad \overset{5}{\text{s.}} \\ 0 \quad 2 \quad 5 \quad 17 \quad 19 \\ \hline 10 \end{array}$$

$$0 \quad 22 \quad 4 \quad 53 \quad 10 = 10 \text{ deg.}$$

$$0 \quad 133 \quad 5 \quad 19 \quad 0 = 60 \text{ deg.}$$

$$2 \quad 68\frac{1}{2} \quad 7 \quad 54 \quad 0 = 360 \text{ deg.}$$

$$\frac{1}{2} = 12 = \frac{1}{2} \text{ day.}$$

$$2 \quad 68 \quad 19 \quad 54 \quad 0 = 360 \text{ deg.}$$

$$\begin{array}{r} \overset{52.}{\text{A.}} \\ 117 \quad 3 \quad 27 \\ \hline 7 \end{array}$$

$$825 \quad 1 \quad 29 = 7 \text{ lots.}$$

$$3301 \quad 2 \quad 36 = 28 \text{ lots.}$$

$$117 \quad 3 \quad 27 = 1 \text{ lot.}$$

$$3419 \quad 2 \quad 23 = 29 \text{ lots.}$$

$$\begin{array}{r} \text{hhd.} \quad \text{gal.} \quad \overset{54.}{\text{qt.}} \quad \text{pt.} \\ 0 \quad 47 \quad 3 \quad 1 \times 3 \\ \hline 7 \end{array}$$

$$5 \quad 20 \quad 0 \quad 1 = 7 \text{ casks.}$$

$$42 \quad 35 \quad 0 \quad 0 = 56 \text{ casks.}$$

$$2 \quad 17 \quad 2 \quad 1 = 3 \text{ casks.}$$

$$44 \quad 52 \quad 2 \quad 1 = 59 \text{ casks.}$$

$$\begin{array}{r} \text{gal.} \quad \overset{56.}{\text{qt.}} \quad \text{pt.} \\ 3 \quad 1 \quad 1 \times 2 \\ \hline 10 \end{array}$$

$$33 \quad 3 \quad 0 = 10 \text{ weeks.}$$

$$168 \quad 3 \quad 0 = 50 \text{ weeks.}$$

$$6 \quad 3 \quad 0 = 2 \text{ weeks.}$$

$$175 \quad 2 \quad 0 = 52 \text{ weeks.}$$

$$\begin{array}{r} \text{£} \quad \overset{51.}{\text{s.}} \quad \text{d.} \quad \text{qr.} \\ 0 \quad 8 \quad 3 \quad 1 \\ \hline 8 \end{array}$$

$$3 \quad 6 \quad 2 \quad 0 = \text{price of } 8 \text{ gal.}$$

$$23 \quad 3 \quad 2 \quad 0 = \text{price of } 56 \text{ gal.}$$

$$8 \quad 3 \quad 1 = \text{price of } 1 \text{ gal.}$$

$$23 \quad 11 \quad 5 \quad 1 = \text{price of } 57 \text{ gal.}$$

$$\begin{array}{r} \overset{53.}{\text{yd.}} \quad \text{qr.} \quad \text{na.} \quad \text{in.} \\ 37 \quad 3 \quad 2 \quad 2 \\ \hline 11 \end{array}$$

$$417 \quad 0 \quad 3 \quad 1\frac{1}{2} = 11 \text{ pieces.}$$

$$3387 \quad 3 \quad 2 \quad 0\frac{1}{2} = 88 \text{ pieces.}$$

$$37 \quad 3 \quad 2 \quad 2 = 1 \text{ piece.}$$

$$3375 \quad 3 \quad 1 \quad 0\frac{1}{4} = 89 \text{ pieces.}$$

$$\begin{array}{r} \overset{55.}{\text{m. fur. rd. ft.}} \\ 17 \quad 3 \quad 13 \quad 14 \times 5 \\ \hline 6 \end{array}$$

$$104 \quad 4 \quad 3 \quad 1\frac{1}{2} = 6 \text{ days.}$$

$$627 \quad 0 \quad 18 \quad 9 = 36 \text{ days.}$$

$$6270 \quad 4 \quad 25 \quad 7\frac{1}{2} = 360 \text{ days.}$$

$$87 \quad 0 \quad 29 \quad 4 = 5 \text{ days.}$$

$$6357 \quad 5 \quad 14 \quad 11\frac{1}{2} = 365 \text{ days.}$$

$$\begin{array}{r} \text{T.} \quad \text{ft.} \quad \text{in.} \\ 0 \quad 37 \quad 978 \\ \hline 8 \end{array}$$

$$7 \quad 20 \quad 912 = 8 \text{ sticks.}$$

$$15 \quad 1 \quad 96 = 16 \text{ sticks.}$$

$$37 \quad 978 = 1 \text{ stick.}$$

$$15 \quad 38 \quad 1074 = 17 \text{ sticks.}$$

58.			
Cords.	ft.		
7	98		
8			
<u>62</u>			<u>16 = 8 piles.</u>
<u>2</u>			
<u>124</u>			<u>32 = 16 piles.</u>
<u>7</u>			<u>98 = 1 pile.</u>
<u>132</u>			<u>2 = 17 piles.</u>

59.			
hhd.	gal.	qt.	pt.
2	19	0	<u>1 × 3</u>
			<u>6</u>
<u>13</u>			<u>51 3 0 = 6</u>
<u>6</u>			
<u>82</u>			<u>58 2 0 = 36</u>
<u>6</u>			<u>57 1 1 = 3</u>
<u>89</u>			<u>52 3 1 = 39</u>

60.				
bu.	pk.	qt.	pt.	gt.
3	1	4	1	<u>1 × 3</u>
				<u>10</u>
<u>33</u>				<u>3 6 0 2 = 10</u>
				<u>5</u>
<u>169</u>				<u>2 7 0 2 = 50</u>
<u>10</u>				<u>0 5 1 3 = 3</u>
<u>179</u>				<u>3 5 0 1 = 53</u>

61.				
ch.	bu.	pk.	qt.	pt.
16	7	2	0	<u>0 × 1</u>
				<u>8</u>
<u>129</u>				<u>24 0 0 0 = 8</u>
				<u>2</u>
<u>259</u>				<u>12 0 0 0 = 16</u>
<u>16</u>				<u>7 2 0 0 = 1</u>
<u>275</u>				<u>19 2 0 0 = 17</u>

BILLS.

1. (p. 81.)

London, July 4, 1835.

Dow, Vance, & Co., of Boston, U. S.,

Bought of Samuel Snow,

		£	s.	d.
45 yds. Broadcloth, at	8s. 4d.,	18	15	0
50 "	" 10s. 6d.,	26	5	0
56 "	" 3s. 7½d.,	10	3	0
63 "	" 12s. 11½d.,	40	17	8½
72 "	" 19s. 11d.,	71	14	0
81 "	" 9s. 3d.,	37	9	3
35 "	" 19s. 7½d.,	34	6	10½
99 "	" 16s. 0½d.,	79	8	1½
66 "	" 8s. 11d.,	29	8	6
33 "	" 16s. 11½d.,	27	19	7½
		<u>376£. 7s. 0½d</u>		

OPERATION.

1. £ s. d.			2. £ s. d.			3. £ s. d. qr.			4. £ s. d. qr.			5. £ s. d.					
0	8	4	0	10	6	0	3	7	2	0	12	11	3	0	19	11	
	9			10			7				9				9		
3	15	0	5	5	0	1	5	4	2	5	16	9	3	8	19	3	
	5			5			8				7				8		
18	15	0	26	5	0	10	3	0	0	40	17	8	1	71	14	0	
6. £ s. d.			7. £ s. d. qr.			8. £ s. d. qr.			9. £ s. d.			10. £ s. d. qr.					
0	9	3	0	19	7	2	0	16	0	2	0	8	11	0	16	11	2
	9			7			11				11				11		
4	3	3	6	17	4	2	8	16	5	2	4	18	1	9	6	6	2
	9			5			9				6				3		
37	9	3	34	6	10	2	79	8	1	2	29	8	6	27	19	7	2

2.

Quebec, Jan. 8, 1835.

Mr. John Vose.

Bought of Vans & Conant.

				£.	s.	d.
46 Ivory Combs,	at	3s.	5½d.,	7	18	1½
47 lbs. Colored Thread,	"	6s.	9½d.,	15	18	2½
51 yds. Durant,	"	1s.	8d.,	4	5	0
52 Silk Vests,	"	6s.	7d.,	17	2	4
53 Leghorns,	"	11s.	9½d.,	31	4	11½
57 ps. Nankin,	"	8s.	3½d.,	23	11	5½
58 lbs. White Thread,	"	9s.	11½d.,	28	16	4½
				120 6	16	

OPERATION-

£.	s.	d.	qr.		5.
0	11	9	2	$\times 3$	
					10
					<hr/>
5	17	11	0		
			5		<hr/>
29	9	7	0		
1	15	4	2		<hr/>
31	4	11	2		

£.	s.	d.	qr.		6.
0	8	3	1	$\times 1$	
					8
					<hr/>
3	6	2	0		
			7		<hr/>
23	3	2	0		
0	8	3	1		<hr/>
23	11	5	1		

£.	s.	d.	qr.		7.
0	9	11	1	$\times 2$	
					7
					<hr/>
3	9	6	3		
			8		<hr/>
27	16	6	0		
0	19	10	2		<hr/>
28	16	4	2		

3.

Mr. James Savage,

Montreal, July 4, 1835.

Bought of Joseph Dowe,

	£.	s.	d.
83 gals. Lisbon Wine,	at	6s.	7d.,
85 " Port do.	"	3s.	9½d.,
86 " Madeira do.	"	4s.	11½d.,
87 " Temperance do.	"	3s.	6½d.,
89 " Oil,	"	5s.	3d.,
91 Leghorns,	"	19s.	10½d.,
92 lbs. Green Tea,	"	3s.	1½d.,
93 pair Thread Hose,	"	4s.	4½d.,
94 " Silk Gloves,	"	3s.	3½d.,
95 " Silk Hose,	"	6s.	6½d.,
97 yds. Linen,	"	5s.	5½d.,
98 gals. Winter-strained Oil,	"	7s.	7½d.,
			<hr/>
			27 6 5

338 £. 19s. 2½d.

OPERATION.

1.	2.	3.	4.														
£.	s.	d.	£.	s.	d.	qr.	£.	s.	d.	qr.							
0	6	7	$\times 2$	0	3	9	$\times 5$	0	4	11	2	$\times 6$	0	3	6	2	$\times 3$
													9	10	10	12	
													<hr/>	<hr/>	<hr/>	<hr/>	
2	19	3		1	17	11	0	2	9	7	0		2	2	6	0	
							8									7	
							<hr/>										
27	13	3		15	3	4	0	19	16	8	0		14	17	6	0	
0	13	2		0	18	11	2	1	9	9	0		0	10	7	2	
							<hr/>										
27	6	5		16	2	3	2	21	6	5	0		15	8	1	2	

£. s. d.	£. s. d. qr.	£. s. d. qr.	£. s. d. qr.
$0\ 5\ 3 \times 1$	$0\ 19\ 10\ 1 \times 1$	$0\ 3\ 1\ 2 \times 2$	$0\ 4\ 4\ 2 \times 3$
$\underline{11}$	$\underline{10}$	$\underline{10}$	$\underline{10}$

$2\ 17\ 9$	$9\ 18\ 6\ 2$	$1\ 11\ 3\ 0$	$2\ 3\ 9\ 0$
$\underline{8}$	$\underline{9}$	$\underline{9}$	$\underline{9}$
$23\ 2\ 0$	$89\ 6\ 10\ 2$	$14\ 1\ 3\ 0$	$19\ 13\ 9\ 0$
$0\ 5\ 3$	$0\ 19\ 10\ 1$	$0\ 6\ 3\ 0$	$0\ 13\ 1\ 2$
$23\ 7\ 3$	$90\ 6\ 8\ 3$	$14\ 7\ 6\ 0$	$20\ 6\ 10\ 2$

| £. s. d. qr.} | $\text{£. s. d. qr.}$ | $\text{£. s. d. qr.}$ | $\text{£. s. d. qr.}$ |
|-----------------------|-----------------------|-----------------------|-----------------------|
| $0\ 3\ 3\ 2 \times 4$ | $0\ 6\ 6\ 2 \times 5$ | $0\ 5\ 5\ 2 \times 1$ | $0\ 7\ 7\ 2 \times 2$ |
| $\underline{10}$ | $\underline{10}$ | $\underline{12}$ | $\underline{12}$ |
| $1\ 12\ 11\ 0$ | $3\ 5\ 5\ 0$ | $3\ 5\ 6\ 0$ | $4\ 11\ 6\ 0$ |
| $\underline{9}$ | $\underline{9}$ | $\underline{8}$ | $\underline{8}$ |
| $4\ 16\ 3\ 0$ | $29\ 8\ 9\ 0$ | $26\ 4\ 0\ 0$ | $36\ 12\ 0\ 0$ |
| $0\ 13\ 2\ 0$ | $1\ 12\ 8\ 2$ | $0\ 5\ 5\ 2$ | $0\ 15\ 3\ 0$ |
| $5\ 9\ 5\ 0$ | $31\ 1\ 5\ 2$ | $26\ 9\ 5\ 2$ | $37\ 7\ 3\ 0$ |

4.

Montreal, June 17, 1835.

Mr. Samuel Simpson,

Bought of Lackington, Grey, & Co.

		£. s. d.
19 yds. Cloth,	at 1s. 6d.,	1 8 6
23 " Worsted,	" 7s. $8\frac{1}{4}$ d.,	8 16 $9\frac{3}{4}$
26 " Baize,	" 3s. $11\frac{1}{2}$ d.,	5 2 11
29 " Camlet,	" 6s. $10\frac{1}{2}$ d.,	9 19 $4\frac{1}{2}$
31 " Bombazine,	" 1s. $5\frac{1}{2}$ d.,	2 4 $6\frac{3}{4}$
34 " Linen,	" 3s. 7d.,	6 1 10
37 " Cotton,	" 11s. 9d.,	21 14 9
38 " Flannel,	" 6s. 11d.,	13 2 10
39 " Calico,	" 3s. $10\frac{1}{4}$ d.,	7 10 $3\frac{3}{4}$
41 " Broadcloth,	" 6s. $9\frac{1}{2}$ d.,	13 18 $5\frac{1}{2}$
43 " Nankin,	" 7s. $5\frac{3}{4}$ d.,	16 1 $7\frac{1}{4}$
		$\underline{106\text{£. } 1\text{s. } 11\frac{1}{4}\text{d.}}$

OPERATION.

<u>1.</u>	<u>2.</u>	<u>3.</u>	<u>4.</u>
$\text{£} \text{ s. d.}$	$\text{£} \text{ s. d. qr.}$	$\text{£} \text{ s. d. qr.}$	$\text{£} \text{ s. d. qr.}$
$0 \ 1 \ 6 \times 1$	$0 \ 7 \ 8 \ 1 \times 2$	$0 \ 3 \ 11 \ 2 \times 1$	$0 \ 6 \ 10 \ 2 \times 1$
<u>9</u>	<u>7</u>	<u>5</u>	<u>7</u>
$0 \ 13 \ 6$	$2 \ 13 \ 9 \ 3$	$0 \ 19 \ 9 \ 2$	$2 \ 8 \ 1 \ 2$
<u>2</u>	<u>3</u>	<u>5</u>	<u>4</u>
$1 \ 7 \ 0$	$8 \ 1 \ 5 \ 1$	$4 \ 18 \ 11 \ 2$	$9 \ 12 \ 6 \ 0$
$0 \ 1 \ 6$	$0 \ 15 \ 4 \ 2$	$0 \ 3 \ 11 \ 2$	$0 \ 6 \ 10 \ 2$
$1 \ 8 \ 6$	$8 \ 16 \ 9 \ 3$	$5 \ 2 \ 11 \ 0$	$9 \ 19 \ 4 \ 2$
 <u>5.</u>	 <u>6.</u>	 <u>7.</u>	 <u>8.</u>
$\text{£} \text{ s. d. qr.}$	$\text{£} \text{ s. d.}$	$\text{£} \text{ s. d.}$	$\text{£} \text{ s. d.}$
$0 \ 1 \ 5 \ 1 \times 1$	$0 \ 3 \ 7 \times 4$	$0 \ 11 \ 9 \times 2$	$0 \ 6 \ 11 \times 2$
<u>10</u>	<u>10</u>	<u>7</u>	<u>6</u>
$0 \ 14 \ 4 \ 2$	$1 \ 15 \ 10$	$4 \ 2 \ 3$	$2 \ 1 \ 6$
<u>3</u>	<u>3</u>	<u>5</u>	<u>6</u>
$2 \ 3 \ 1 \ 2$	$5 \ 7 \ 6$	$20 \ 11 \ 3$	$12 \ 9 \ 0$
$0 \ 1 \ 5 \ 1$	$0 \ 14 \ 4$	$1 \ 3 \ 6$	$0 \ 13 \ 10$
$2 \ 4 \ 6 \ 3$	$6 \ 1 \ 10$	$21 \ 14 \ 9$	$13 \ 2 \ 10$
 <u>9.</u>	 <u>10.</u>	 <u>11.</u>	
$\text{£} \text{ s. d. qr.}$	$\text{£} \text{ s. d. qr.}$	$\text{£} \text{ s. d. qr.}$	
$0 \ 3 \ 10 \ 1 \times 3$	$0 \ 6 \ 9 \ 2 \times 1$	$0 \ 7 \ 5 \ 3 \times 3$	
<u>6</u>	<u>10</u>	<u>10</u>	
$1 \ 3 \ 1 \ 2$	$3 \ 7 \ 11 \ 0$	$3 \ 14 \ 9 \ 2$	
<u>6</u>	<u>4</u>	<u>4</u>	
$6 \ 18 \ 9 \ 0$	$13 \ 11 \ 8 \ 0$	$14 \ 19 \ 2 \ 0$	
$0 \ 11 \ 6 \ 3$	$0 \ 6 \ 9 \ 2$	$1 \ 2 \ 5 \ 1$	
$7 \ 10 \ 3 \ 3$	$13 \ 18 \ 5 \ 2$	$16 \ 1 \ 7 \ 1$	

5.

Liverpool, June 2, 1835.

John Jones, of Philadelphia, U. S.,

Bought of Thomas Hasseltine,

	<u>£.</u>	<u>s.</u>	<u>d.</u>
297 yds. Black Broadcloth, at 17s. 3½d.,	256	15	7½
473 " Blue do. " 9s. 11½d.,	235	0	5½
512 " Red do. " 15s. 10d.,	405	6	8

Amount forward,

 $897 \text{£. } 2\text{s. } 8\frac{1}{2}\text{d}$

	Amount brought forward,	$\frac{\text{£}}{\text{s.}} \frac{\text{d.}}{\text{qr.}}$	$\frac{\text{£}}{\text{s.}} \frac{\text{d.}}{\text{qr.}}$	$\frac{\text{£}}{\text{s.}} \frac{\text{d.}}{\text{qr.}}$
624 yds. Green Broadcloth, at 12s. 8d.,	395	4	0	
765 " White do. " 19s. 9½d.,	757	0	7½	
169 " Black Velvet, " 13s. 5½d.,	113	10	11½	
698 " Green do. " 15s. 6½d.,	543	2	7½	
315 " Red do. " 14s. 3½d.,	225	1	10½	
713 " White do. " 11s. 7½d.,	414	8	7½	
519 " Carpet, " 13s. 6½d.,	350	17	3½	
147 " Black Kerseymere, " 16s. 7½d.,	122	6	11½	
386 " Blue do. " 14s. 3½d.,	275	8	6½	
137 " Green do. " 19s. 9d.,	135	5	9	
999 " Black Silk, " 15s. 8d.,	782	11	0	
	5012	0	0s. 11½d.	

OPERATION.

$\frac{\text{£}}{\text{s.}} \frac{\text{d.}}{\text{qr.}}$	$\frac{\text{£}}{\text{s.}} \frac{\text{d.}}{\text{qr.}}$	$\frac{\text{£}}{\text{s.}} \frac{\text{d.}}{\text{qr.}}$	$\frac{\text{£}}{\text{s.}} \frac{\text{d.}}{\text{qr.}}$
$\frac{0}{17} \frac{1}{3} \frac{2}{7} \times 7$	$\frac{0}{9} \frac{9}{11} \frac{1}{3} \times 3$	$\frac{0}{15} \frac{1}{10} \frac{10}{2} \times 2$	$\frac{0}{12} \frac{6}{8} \frac{8}{4} \times 4$
10	10	10	10
8 12 11 0 × 9	4 19 4 2 × 7	7 18 4 × 1	6 6 8 × 2
10	10	10	10
86 9 2 0	49 13 9 0	79 3 4	63 6 8
2	4	5	6
172 18 4 0	198 15 0 0	395 16 8	380 0 0
77 16 3 0	34 15 7 2	7 18 4	12 13 4
6 1 0 2	1 9 9 3	1 11 8	2 10 8
256 15 7 2	235 0 5 1	405 6 8	395 4 0
$\frac{\text{£}}{\text{s.}} \frac{\text{d.}}{\text{qr.}}$	$\frac{\text{£}}{\text{s.}} \frac{\text{d.}}{\text{qr.}}$	$\frac{\text{£}}{\text{s.}} \frac{\text{d.}}{\text{qr.}}$	$\frac{\text{£}}{\text{s.}} \frac{\text{d.}}{\text{qr.}}$
$\frac{0}{19} \frac{9}{2} \frac{5}{2} \times 5$	$\frac{0}{13} \frac{5}{1} \frac{9}{9} \times 9$	$\frac{0}{15} \frac{6}{3} \frac{7}{8} \times 8$	
10	10	10	
9 17 11 0 × 6	6 14 4 2 × 6	7 15 7 2 × 9	
10	10	10	
98 19 2 0	67 3 9 0	77 16 3 0	
7	40 6 3 0	6	
692 14 2 0	6 0 11 1	466 17 6 0	
59 7 6 0	113 10 11 1	70 0 7 2	
4 18 11 2		6 4 6 0	
757 0 7 2		543 2 7 2	

$\frac{f.}{0} \frac{s.}{14} \frac{d.}{3} \frac{qr.}{2 \times 5}$	$\frac{f.}{0} \frac{s.}{11} \frac{d.}{7} \frac{qr.}{2 \times 3}$	$\frac{f.}{0} \frac{s.}{13} \frac{d.}{6} \frac{qr.}{1 \times 9}$
$\frac{10}{7 \ 2 \ 11 \ 0 \times 1}$	$\frac{10}{5 \ 16 \ 3 \ 0 \times 1}$	$\frac{10}{6 \ 15 \ 2 \ 2 \times 1}$
$\frac{10}{71 \ 9 \ 2 \ 0}$	$\frac{10}{58 \ 2 \ 6 \ 0}$	$\frac{10}{67 \ 12 \ 1 \ 0}$
$\frac{3}{214 \ 7 \ 6 \ 0}$	$\frac{406}{5 \ 16 \ 3 \ 0}$	$\frac{5}{338 \ 0 \ 5 \ 0}$
$\frac{7}{7 \ 2 \ 11 \ 0}$	$\frac{406}{1 \ 14 \ 10 \ 2}$	$\frac{6}{6 \ 15 \ 2 \ 2}$
$\frac{3}{3 \ 11 \ 5 \ 2}$	$\frac{414}{8 \ 7 \ 2}$	$\frac{6}{6 \ 18 \ 1}$
$\frac{225}{225 \ 1 \ 10 \ 2}$	$\frac{414}{8 \ 7 \ 2}$	$\frac{350}{350 \ 17 \ 3 \ 3}$
$\frac{f.}{0} \frac{s.}{16} \frac{d.}{7} \frac{qr.}{3 \times 7}$	$\frac{f.}{0} \frac{s.}{14} \frac{d.}{3} \frac{qr.}{1 \times 6}$	$\frac{f.}{0} \frac{s.}{19} \frac{d.}{9} \frac{qr.}{7}$
$\frac{10}{8 \ 6 \ 5 \ 2 \times 4}$	$\frac{10}{7 \ 2 \ 8 \ 2 \times 8}$	$\frac{10}{9 \ 17 \ 6 \times 3}$
$\frac{10}{83 \ 4 \ 7 \ 0}$	$\frac{10}{71 \ 7 \ 1 \ 0}$	$\frac{10}{78 \ 6 \ 8}$
$\frac{33 \ 5 \ 10 \ 0}{5 \ 16 \ 6 \ 1}$	$\frac{3}{214 \ 1 \ 3 \ 0}$	$\frac{9}{29 \ 12 \ 6}$
$\frac{122 \ 6 \ 11 \ 1}{214 \ 1 \ 3 \ 0}$	$\frac{6}{57 \ 1 \ 8 \ 0}$	$\frac{9}{6 \ 18 \ 3}$
$\frac{4}{4 \ 5 \ 7 \ 2}$	$\frac{135}{4 \ 5 \ 7 \ 2}$	$\frac{705}{135 \ 5 \ 9} \ 0 \ 0$
$\frac{275}{275 \ 8 \ 6 \ 2}$		$\frac{70}{7 \ 1 \ 0}$
		$\frac{782}{782 \ 11 \ 0}$

SECTION XV.

COMPOUND DIVISION.

$9) \underline{10 \ 13 \ 0}^{\text{2. (p. 85.)}}$	$7) \underline{10 \ 0 \ 4 \ 2}^{\text{3.}}$	$8) \underline{3 \ 2 \ 4}^{\text{4.}}$
$1 \ 3 \ 8$	$1 \ 8 \ 7 \ 2$	$0 \ 7 \ 9\frac{1}{2}$
$5) \underline{54 \ 2 \ 3}^{\text{5.}}$	$9) \underline{29 \ 3 \ 16}^{\text{6.}}$	$5) \underline{37 \ 17 \ 0 \ 16}^{\text{7.}}$
$10 \ 3 \ 3$	$3 \ 1 \ 8$	$7 \ 11 \ 1 \ 20$
$10) \underline{76 \ 11 \ 53 \ 0}^{\text{8.}}$		$9) \underline{151 \ 19 \ 11 \ 1}^{\text{9.}}$
$7 \ 15 \ 35 \ 18$		$16 \ 17 \ 9 \ 1$

$$\begin{array}{r} \text{10.} \\ \begin{array}{r} \frac{f.}{s.} \frac{d.}{qr.} \\ 519)350 \quad 17 \quad 3 \quad 3(0\text{£.} \end{array} \end{array} \quad \begin{array}{r} \text{11.} \\ \begin{array}{r} \frac{f.}{s.} \frac{d.}{qr.} \\ 63)225 \quad 1 \quad 10 \quad 2(3\text{£.} \end{array} \end{array} \quad \begin{array}{r} \text{12.} \\ \begin{array}{r} \frac{f.}{s.} \frac{d.}{qr.} \\ 12)159 \quad 4 \quad 9 \quad 0 \end{array} \end{array}$$

$$\begin{array}{r} \underline{20} \\ 189 \\ \hline 13 \ 5 \ 4 \ 3 \end{array}$$

$$\begin{array}{r} \begin{array}{r} 519 \\ \underline{7017}(13s. \end{array} \\ \begin{array}{r} \frac{f.}{s.} \frac{d.}{qr.} \\ 63)721(11s. \end{array} \end{array} \quad \begin{array}{r} \frac{f.}{s.} \frac{d.}{qr.} \\ 4)75 \quad 6 \quad 6 \quad 0 \end{array}$$

$$\begin{array}{r} \underline{36} \\ \underline{63} \\ \begin{array}{r} 1827 \\ 1557 \\ \hline 270 \\ 12 \\ \hline 91 \\ 63 \end{array} \\ \begin{array}{r} 18 \ 16 \ 7 \ 2 \end{array} \end{array}$$

$$\begin{array}{r} \begin{array}{r} 519)3243(6d. \\ 3114 \\ \underline{129} \\ 4 \\ \hline 315 \end{array} \\ \begin{array}{r} \frac{f.}{s.} \frac{d.}{qr.} \\ 63)346(5d. \end{array} \end{array} \quad \begin{array}{r} \frac{f.}{s.} \frac{d.}{qr.} \\ 7)111 \quad 8 \quad 11 \\ \hline 15 \ 18 \ 5 \end{array}$$

$$\begin{array}{r} \begin{array}{r} 519)519(1qr. \\ 519 \\ \hline 4 \end{array} \\ \begin{array}{r} \frac{f.}{s.} \frac{d.}{qr.} \\ 63)126(2qr. \end{array} \end{array} \quad \begin{array}{r} \frac{f.}{s.} \frac{d.}{qr.} \\ 12)159 \quad 4 \quad 9 \quad 0 \\ \hline 13 \ 5 \ 4 \ 3 \end{array}$$

$$\begin{array}{r} \begin{array}{r} \text{lb. oz. dwt. gr.} \\ 9)158 \quad 9 \quad 1 \quad 21 \end{array} \\ \begin{array}{r} \frac{lb.}{17} \frac{oz.}{7} \frac{dwt.}{13} \frac{gr.}{13} \end{array} \end{array} \quad \begin{array}{r} \begin{array}{r} \text{lb. oz. dwt. gr.} \\ 7)111 \quad 11 \quad 17 \quad 9 \end{array} \\ \begin{array}{r} \frac{lb.}{15} \frac{oz.}{11} \frac{dwt.}{19} \frac{gr.}{15} \end{array} \end{array} \quad \begin{array}{r} \begin{array}{r} \text{T. cwt. qr. lb. oz.} \\ 11)183 \quad 1 \quad 2 \quad 11 \quad 4 \end{array} \\ \begin{array}{r} \frac{T.}{16} \frac{cwt.}{12} \frac{qr.}{3} \frac{lb.}{3} \frac{oz.}{13} \frac{4}{12} \end{array} \end{array}$$

$$\begin{array}{r} \begin{array}{r} \text{T. cwt. qr. lb. oz.} \\ 8)105 \quad 7 \quad 0 \quad 6 \quad 8 \end{array} \\ \begin{array}{r} \frac{T.}{13} \frac{cwt.}{3} \frac{qr.}{3} \frac{lb.}{1} \frac{oz.}{14} \frac{8}{13} \end{array} \end{array} \quad \begin{array}{r} \begin{array}{r} \text{lb. oz. gr.} \\ 8)19 \quad 9 \quad 4 \quad 2 \quad 9 \end{array} \\ \begin{array}{r} \frac{lb.}{2} \frac{oz.}{5} \frac{gr.}{5} \frac{lb.}{1} \frac{oz.}{16\frac{1}{2}} \end{array} \end{array} \quad \begin{array}{r} \begin{array}{r} \text{yd. qr. na. in.} \\ 7)335 \quad 2 \quad 0 \quad 0 \quad \frac{1}{2} \end{array} \\ \begin{array}{r} \frac{yd.}{47} \frac{qr.}{3} \frac{na.}{2} \frac{in.}{2} \end{array} \end{array}$$

$$\begin{array}{r} \begin{array}{r} \text{m. fur. rd. ft. in.} \\ 12)215 \quad 7 \quad 1 \quad 14 \quad 6 \end{array} \\ \begin{array}{r} \frac{m.}{17} \frac{fur.}{7} \frac{rd.}{1} \frac{ft.}{14} \frac{in.}{6} \end{array} \end{array} \quad \begin{array}{r} \begin{array}{r} \text{deg. fur. rd. yd. ft. in.} \\ 9)149 \quad \frac{8}{0} \quad 0 \quad 1 \quad 1 \quad 6 \end{array} \\ \begin{array}{r} \frac{deg.}{16} \frac{fur.}{39} \frac{rd.}{4} \frac{yd.}{0} \frac{ft.}{0} \frac{in.}{6} \end{array} \end{array}$$

The answer to No. 23 is correct. But if we subtract 1 furlong from the 4 furlongs, there will remain 3 furlongs. Then, if we add its equal, 39 rods and $5\frac{1}{2}$ yards, — which together are equal to 1 furlong, — to their respective denominations, we obtain another quotient equal in value to the former. But $5\frac{1}{2}$ yards are 5yd. 1ft. 6in., and this we substitute for $5\frac{1}{2}$ yards. The operation will be as follows: —

deg.	m.	fur.	rd.	yd.	ft.	in.
16	39	4	0	0	0	6
		1				
16	39	3	0	0	0	6
			39	5	1	6
16	39	3	39	5	2	0

Thus we perceive the value of the two answers is the same. This process we are obliged to take to obtain the answer given on page 79.

deg.	m.	fur.	rd.	ft.	in.	bar.
6) 97	55	7	35	4	2	1
16	20	7	12	8	11	$1\frac{1}{8}$
						6
97	55	3	35	3	8	1
	$\frac{1}{2}=4$			$\frac{1}{2}=6$		
97	55	7	35	4	2	1

In this question we add the $\frac{1}{2}$ mile, = 4 furlongs, to the 3 furlongs, and the $\frac{1}{2}$ foot, = 6 inches, to the 8 inches, and we obtain a correct answer without fractions.

A.	R.	p.	25.	yd.	ft.	in.	Cords.	26.	ft.	in.	27.
11) 181	3	11	6	4	41		4) 31	83	1332		7) 209
16	2	4	19	7	79			7	116	1629	29

Tuns.	hhd.	gal.	qt.	28.	hhd.	gal.	qt.	pt.	29.	bu.	pk.	qt.	pt.	
9) 35	3	4	2		8) 56	45	0	0		6) 118	1	5	0	0
3	3	56	2		7	5	2	1		19	2	7	1	

ch.	bu.	pk.	qt.	31.	y.	d.	h.	m.	sec.	32.	33.
7) 255	24	3	1		8) 110	343	3	41	12		9) 214
36	18	3	7		13	316	15	27	39		23

d.	h.	m.	sec.	34.	bu.	pk.	qt.	35.	f.	s.	d.	36.
12) 3	16	54	0		8) 29	0	0		4) 2	18	8	9) 71
0	7	24	30		3	2	4		4) 0	14	8	8) 7

d.	h.	m.	sec.	39.	T.	cwt.	qr.	lb.	40.	£	s.	d.	41.
12) 8	1	0			10) 56	13	3	10		6) 5	4	3	0
7) 0	13	5			9) 5	13	1	15		3) 0	17	4	2

$$\begin{array}{r} \text{43.} \\ 11) \underline{\text{12} \text{ 13} \text{ 0}} \\ \text{2) } \underline{\text{1} \text{ 3} \text{ 0}} \\ \text{0} \text{ 11} \text{ 6} \end{array}$$

$$\begin{array}{r} \text{44.} \\ 12) \underline{\text{1290} \text{ 4} \text{ 0} \text{ 0}} \\ \text{8) } \underline{\text{107} \text{ 10} \text{ 4} \text{ 0}} \\ \text{13} \text{ 8} \text{ 9} \text{ 2} \end{array}$$

$$\begin{array}{r} \text{45.} \\ 12) \underline{\text{32} \text{ 9} \text{ 15} \text{ 0}} \\ \text{10) } \underline{\text{2} \text{ 8} \text{ 16} \text{ 6}} \\ \text{0} \text{ 3} \text{ 5} \text{ 15} \end{array}$$

$$\begin{array}{r} \text{46.} \\ 6) \underline{\text{746} \text{ 5} \text{ 0}} \\ \text{5) } \underline{\text{124} \text{ 3} \text{ 20}} \\ \text{24} \text{ 7} \text{ 4} \end{array}$$

$$\begin{array}{r} \text{47.} \\ 10) \underline{\text{15} \text{ 0}} \\ \text{6) } \underline{\text{1} \text{ 30}} \\ \text{0} \text{ 15} \end{array}$$

$$\begin{array}{r} \text{48.} \\ 8) \underline{\text{1275} \text{ 2} \text{ 16} \text{ 22} \text{ 8}} \\ \text{4) } \underline{\text{159} \text{ 1} \text{ 32} \text{ 2} \text{ 7} \text{ 112}} \\ \text{39} \text{ 3} \text{ 18} \text{ 0} \text{ 6} \text{ 64} \\ \text{1} \end{array}$$

$$\begin{array}{r} \text{49.} \\ 12) \underline{\text{2} \text{ 68} \text{ 19} \text{ 54} \text{ 0}} \\ \text{10) } \underline{\text{0} \text{ 66} \text{ 14} \text{ 39} \text{ 30}} \\ \text{3) } \underline{\text{0} \text{ 6} \text{ 15} \text{ 51} \text{ 57}} \\ \text{0} \text{ 2} \text{ 5} \text{ 17} \text{ 19} \end{array}$$

$$\begin{array}{r} \text{39} \text{ 3} \text{ 17} \text{ 0} \text{ 6} \text{ 64} \\ \text{30} \text{ 2} \text{ 36} \\ \hline \text{39} \text{ 3} \text{ 17} \text{ 30} \text{ 8} \text{ 100} \end{array}$$

Note. The first answer is correct, and the last has the same value, for 1 pole is equal to 30yd. 2ft. 36in.

$$53) \underline{\text{1001} \text{ 9} \text{ 7}}(18\mathcal{E}.$$

$$57) \underline{\text{23} \text{ 11} \text{ 5} \text{ 1}}(0\mathcal{E}.$$

$$\begin{array}{r} \text{53} \\ \underline{471} \\ \text{424} \\ \underline{47} \\ \text{20} \\ \hline \end{array}$$

$$53) \underline{949}(17s.$$

$$\begin{array}{r} \text{53} \\ \underline{419} \\ \text{371} \\ \underline{48} \\ \text{12} \\ \hline \end{array}$$

$$53) \underline{583}(11d.$$

$$\begin{array}{r} \text{53} \\ \underline{53} \\ \text{53} \\ \hline \end{array}$$

$$57) \underline{\text{471}}(\text{8s.}$$

$$\begin{array}{r} \text{57} \\ \underline{456} \\ \text{15} \\ \underline{12} \\ \hline \end{array}$$

$$57) \underline{185}(3d.$$

$$\begin{array}{r} \text{57} \\ \underline{171} \\ \text{14} \\ \underline{4} \\ \hline \end{array}$$

$$57) \underline{57}(1qr.$$

$$29) \underline{\text{3419} \text{ 2}}(23(117A.$$

$$\begin{array}{r} \text{29} \\ \hline \text{51} \end{array}$$

$$\begin{array}{r} \text{29} \\ \hline \text{229} \end{array}$$

$$\begin{array}{r} \text{203} \\ \hline \text{26} \end{array}$$

$$\begin{array}{r} \text{203} \\ \hline \text{4} \end{array}$$

$$29) \underline{106}(3R.$$

$$\begin{array}{r} \text{87} \\ \hline \text{19} \end{array}$$

$$\begin{array}{r} \text{40} \\ \hline \text{58} \end{array}$$

$$\begin{array}{r} \text{58} \\ \hline \text{203} \end{array}$$

	55.
365) 6357	m. fur. ra. , ft.
5	14 11½(17m.)
365	
2707	
2555	
152	
8	
365) 1221	(3fur.
1095	
126	
40	
365) 5054	(13rd.
365	
1404	
(Carried up.)	
	(Brought up.)
	1404
	1095
	309
	16½
	1855½
	310
	154½
	365
	1460
	1460

56. 3gal. 1qt. 1pt.	65. 4T. 15cwt. 2qr. 12 $\frac{2}{3}$ lb.
57. 37ft. 978in.	66. 19m. 3fur. 39rd. 13ft. $2\frac{2}{3}$ in.
58. 7 cords 98 cubic feet.	68. 9A. 1R. 19p. 139 $\frac{1}{3}$ ft.
59. 2hhd. 19gal. 0qt. 1pt.	69. 13A. 0R. 27p. 3yd. 0ft. $45\frac{8}{11}$ in.
60. 3bu. 1pk. 4qt. 1pt. 1gi.	70. 142£. 19s. 1 $\frac{1}{4}$ d.
61. 16ch. 7bu. 2pk. 0qt. 0pt.	71. 14£. 7s. 10 $\frac{1}{4}$ d.
62. 2£. 1s. 3 $\frac{2}{3}$ d.	72. \$ 1001.34.
63. 1£. 1s. 8 $\frac{5}{7}$ d.	
64. 17£. 6s. 1 $\frac{1}{2}$ d.	

QUESTIONS TO BE PERFORMED BY ANALYSIS.

1. (p. 88.) $\$8.75 \div 7 = \1.25 ; $\$1.25 \times 20 = \25.00 Ans.
2. $\$85 \div 5 = \17 ; $\$17 \times 17 = \289 Ans.
3. $\$0.75 \div 3 = \0.25 ; $\$0.25 \times 37 = \9.25 Ans.
4. $\$1.92 \div 4 = \0.48 ; $\$0.48 \times 37 = \17.76 Ans.
5. $\$1.08 \div 12 = \0.09 ; $\$0.09 \times 25 = \2.25 Ans.
6. $\$63 \div 9 = \7 ; $\$7 \times 27 = \189 Ans.
7. $20 \div 5 = 4$; $28 \div 4 = 7$ hours, Ans.
8. $49 \div 7 = 7$; $7 \times 19 = 133$ crackers, Ans.
9. $\$20 \div 5 = \4 ; $\$4 \times 40 = \160 Ans.
10. $\$0.36 \div 3 = \0.12 ; $\$0.12 \times 37 = \4.44 Ans.
11. $\$0.72 \div 9 = \0.08 ; $\$0.08 \times 37 = \2.96 Ans.
12. $2\text{£. } 17\text{s. } 5\text{d.} \div 52 = 1\text{s. } 1\frac{1}{4}\text{d.}$; $1\text{s. } 1\frac{1}{4}\text{d.} \times 76 = 4\text{£. } 3\text{s. } 11\text{d.}$ Ans.
13. $4\text{£. } 3\text{s. } 11\text{d.} \div 76 = 1\text{s. } 1\frac{1}{4}\text{d.}$; $1\text{s. } 1\frac{1}{4}\text{d.} \times 52 = 2\text{£. } 17\text{s. } 5\text{d.}$ Ans.
14. $2\text{£. } 17\text{s. } 5\text{d.} \div 52 = 1\text{s. } 1\frac{1}{4}\text{d.}$; $4\text{£. } 3\text{s. } 11\text{d.} \div 1\text{s. } 1\frac{1}{4}\text{d.} = 76\text{lb.}$ Ans.
15. $4\text{£. } 3\text{s. } 11\text{d.} \div 76 = 1\text{s. } 1\frac{1}{4}\text{d.}$; $2\text{£. } 17\text{s. } 5\text{d.} \div 1\text{s. } 1\frac{1}{4}\text{d.} = 52\text{lb.}$ Ans.
16. $8\text{£. } 3\text{s. } 11\text{d.} \div 20 = 8\text{s. } 2\frac{7}{20}\text{d.}$; $8\text{s. } 2\frac{7}{20}\text{d.} \times 200 = 81\text{£. } 19\text{s. } 2\text{d.}$ Ans.
17. $81\text{£. } 19\text{s. } 2\text{d.} \div 200 = 8\text{s. } 2\frac{7}{20}\text{d.}$; $8\text{s. } 2\frac{7}{20}\text{d.} \times 20 = 8\text{£. } 3\text{s. } 11\text{d.}$ Ans.

18. 3£. 4s. 2d. \div 10 = 6s. 5d.; 6s. 5d. \times 97 = 31£. 2s.
5d. Ans.
19. 2£. 12s. \div 8 = 6s. 6d.; 6s. 6d. \times 29 = 9£. 8s. 6d. Ans.
20. 6£. 13s. 2d. \div 17 = 7s. 10d.; 7s. 10d. \times 101 = 39£.
11s. 2d. Ans.
21. 10£. 4s. 3d. \div 19 = 10s. 9d.; 10s. 9d. \times 97 = 52£.
2s. 9d. Ans.
-

SECTION XVI.

VULGAR FRACTIONS.

CASE I.

2. (p. 92.)	56	7.	1	12.	1
3.	32	8.	1	13.	671
4.	57	9.	12	14.	4
5.	1	10.	15	15.	3
6.	35	11.	78		

CASE II.

2. (p. 93.)	$\frac{4}{5}$	6.	$\frac{3}{5}$	10.	$\frac{8}{11}\frac{1}{8}$
3.	$\frac{3}{4}$	7.	$\frac{5}{12}\frac{1}{2}$	11.	$\frac{6}{11}$
4.	$\frac{3}{2}$	8.	$\frac{1}{2}$	12.	$\frac{4}{9}\frac{2}{3}$
5.	$\frac{7}{4}$	9.	$\frac{4}{3}\frac{1}{6}$	13.	$\frac{4}{15}\frac{1}{2}$

CASE III.

2. (p. 94.)	$\frac{17}{11}$	10.	$\frac{22221}{11111}$	17.	$\frac{222222}{111111}$
3.	$\frac{19}{11}$	11.	$\frac{24442}{11111}$	18.	$\frac{7}{11}$
4.	$\frac{4878}{1111}$	12.	$\frac{54443}{11111}$	19.	$\frac{11}{11}$
5.	$\frac{205522}{11111}$	13.	$\frac{101032}{11111}$	20.	$\frac{1}{11}$
6.	$\frac{22777}{11111}$	14.	$\frac{122222}{11111}$	21.	$\frac{10}{11}$
7.	$\frac{10146}{55}$	15.	$\frac{182222}{307}$	23.	$\frac{9}{11}$
8.	$\frac{8554}{55}$	16.	$\frac{22244}{207}$	24.	$\frac{24}{11}$
9.	$\frac{7197}{61}$				

CASE IV.

2. (p. 95.)	$11\frac{2}{5}$	5.	$3\frac{1}{5}\frac{1}{5}$	8.	125
3.	$14\frac{7}{15}$	6.	$111\frac{1}{5}$	9.	1
4.	$7\frac{2}{7}$	7.	$91\frac{2}{5}$		

CASE V.

9. (p. 97.) $\frac{2}{3} = \frac{2}{3} \times \frac{1}{2} = \frac{1}{3}$ Ans.

10. $\frac{8}{3} = \frac{8}{3} \times \frac{1}{4} = \frac{2}{3} = 2\frac{1}{3}$ Ans.

11. $\frac{4}{2} = \frac{4}{2} \times \frac{1}{2} = \frac{1}{2} = \frac{1}{2}$ Ans.

12. $\frac{5\frac{1}{2}}{\frac{1}{2}} = \frac{11}{2} = \frac{11}{2} \times \frac{1}{2} = \frac{11}{4} = 12\frac{1}{4}$ Ans.

13. $\frac{1}{6\frac{1}{2}} = \frac{1}{\frac{13}{2}} = \frac{1}{\frac{13}{2}} \times \frac{2}{13} = \frac{2}{13} = \frac{1}{13}$ Ans.

14. $\frac{3}{2\frac{1}{2}} = \frac{3}{\frac{5}{2}} = \frac{3}{\frac{5}{2}} \times \frac{2}{5} = \frac{6}{25} = 1\frac{1}{25}$ Ans.

15. $\frac{3\frac{1}{2}}{\frac{1}{2}} = \frac{7}{2} = \frac{7}{2} \times \frac{1}{2} = \frac{7}{4}$ Ans.

16. $\frac{11\frac{2}{3}}{12\frac{3}{5}} = \frac{\frac{35}{3}}{\frac{63}{5}} = \frac{35}{3} \times \frac{5}{63} = \frac{175}{189} = 2\frac{1}{189}$ Ans.

17. $\frac{11\frac{1}{5}}{7} = \frac{\frac{56}{5}}{7} = \frac{56}{5} \times \frac{1}{7} = \frac{8}{5} = 1\frac{3}{5}$ Ans.

CASE VI.

2. (p. 97.) $77\frac{9}{20} = 8\frac{5}{8}$.

3. $9\frac{19}{50} = 10\frac{1}{5}$.

4. $14\frac{6}{25} = 14\frac{1}{5}$.

5. $2\frac{1}{5}\frac{1}{5} = 2\frac{1}{11}$.

6. $5067\frac{3}{50} = 5758\frac{1}{4}$.

CASE VII.

3. (p. 101.) 360 | 5.

4. 798 | 6.

4*

3600 | 7.

6300 | 8.

27600

60 quarts.

CASE VIII.

- | | |
|--|--|
| 3. (p. 104.) $\frac{720}{1920}, \frac{724}{1920}$. | 17. $\frac{660}{1920}, \frac{668}{1920}, \frac{676}{1920}$. |
| $\frac{1320}{1920}, \frac{1740}{1920}$. | 18. $\frac{640}{1920}, \frac{672}{1920}, \frac{616}{1920}$. |
| 4. $\frac{12}{14}, \frac{14}{14}, \frac{12}{14}, \frac{14}{14}$. | 19. $\frac{824}{1920}, \frac{822}{1920}, \frac{824}{1920}$. |
| 5. $\frac{22}{22}, \frac{22}{22}, \frac{22}{22}, \frac{22}{22}$. | 20. $\frac{2280}{1920}, \frac{2280}{1920}, \frac{2285}{1920}$. |
| 6. $\frac{818}{1920}, \frac{818}{1920}, \frac{818}{1920}, \frac{818}{1920}$. | 21. $\frac{2285}{1920}, \frac{2285}{1920}, \frac{2285}{1920}$. |
| 7. $\frac{88}{88}, \frac{88}{88}, \frac{88}{88}, \frac{88}{88}$. | 22. $\frac{22}{22}, \frac{22}{22}, \frac{22}{22}, \frac{22}{22}$. |
| 8. $\frac{884}{1920}, \frac{884}{1920}, \frac{884}{1920}, \frac{884}{1920}$. | 23. $\frac{1188}{1920}, \frac{1188}{1920}, \frac{1188}{1920}$. |
| 9. $\frac{120}{120}, \frac{120}{120}, \frac{120}{120}, \frac{120}{120}$. | 24. $\frac{24}{24}, \frac{24}{24}, \frac{24}{24}, \frac{24}{24}$. |
| 10. $\frac{168}{1920}, \frac{168}{1920}, \frac{168}{1920}, \frac{168}{1920}$. | 25. $\frac{120}{1920}, \frac{120}{1920}, \frac{120}{1920}$. |
| 11. $\frac{22}{22}, \frac{22}{22}, \frac{22}{22}, \frac{22}{22}$. | 26. $\frac{12014}{1920}, \frac{12014}{1920}, \frac{12014}{1920}$, |
| 12. $\frac{222}{1920}, \frac{222}{1920}, \frac{222}{1920}, \frac{222}{1920}$. | $\frac{12007}{1920}, \frac{12007}{1920}$. |
| 13. $\frac{660}{1920}, \frac{668}{1920}, \frac{668}{1920}, \frac{668}{1920}$. | 27. $\frac{2228118}{17843152}, \frac{2228118}{17843152},$ |
| 14. $\frac{240}{1920}, \frac{240}{1920}, \frac{240}{1920}, \frac{240}{1920}$. | $\frac{7228113}{17843152}$. |
| 15. $\frac{12}{13}, \frac{14}{13}, \frac{16}{13}, \frac{18}{13}$. | |

OPERATION.

$$28. \frac{4}{6\frac{2}{3}} = \frac{4}{2\frac{2}{3}} = \frac{4}{1} \times \frac{3}{2\frac{2}{3}} = \frac{3}{5}$$

$$\frac{7\frac{1}{2}}{9} = \frac{\frac{15}{2}}{\frac{9}{1}} = \frac{15}{2} \times \frac{1}{9} = \frac{5}{6}$$

$$\frac{3\frac{1}{4}}{11\frac{1}{4}} = \frac{\frac{15}{4}}{\frac{45}{4}} = \frac{15}{4} \times \frac{4}{45} = \frac{1}{3}$$

$$\begin{array}{r} 2 \\ \times 5, \frac{1}{2}, \frac{1}{3} \\ \hline 5, 2, 3 \end{array}$$

$$3 \times 5 \times 2 \times 3 = 90$$

$$\begin{array}{r} 90 \\ 5 \overline{) 18 \times 3} = 54 \\ 6 \overline{) 15 \times 5} = 75 \end{array}$$

$$3 \times 20 \times 1 = 20$$

$\frac{4}{5}, \frac{7}{6}, \frac{3}{5}$, Ans.

OPERATION.

$$29. \frac{3}{11\frac{1}{4}} = \frac{\frac{3}{4}}{11\frac{1}{4}} = \frac{3}{8} \times \frac{4}{45} = \frac{1}{30}$$

1
2 15

$$\frac{6\frac{1}{2}}{31\frac{1}{3}} = \frac{\frac{13}{2}}{31\frac{1}{3}} = \frac{13}{3} \times \frac{3}{95} = \frac{1}{5}$$

1
5

$$\frac{294}{654} = \frac{294}{654} = \frac{294}{7} \times \frac{7}{459} = \frac{4}{9}$$

4
9

$$3) \overline{30} \quad \begin{matrix} 1 \\ 10 \end{matrix} \quad \begin{matrix} 1 \\ 3 \end{matrix} \quad \begin{matrix} 4 \\ 3 \end{matrix} \quad \begin{array}{r} 90 \\ 3 \times 1 = 3 \\ 5 \mid 18 \times 1 = 18 \\ 9 \mid 10 \times 4 = 40 \end{array}$$

$$3 \times 10 \times 3 = 90$$

$\frac{4}{9}, \frac{13}{5}, \frac{4}{9}$, Ans.

OPERATION.

$$30. \frac{16}{1} = \frac{16}{1}. \quad \frac{8\frac{4}{5}}{11\frac{1}{5}} = \frac{\frac{44}{5}}{11\frac{1}{5}} = \frac{44}{5} \times \frac{10}{117} = \frac{88}{117}$$

2
1

$$\frac{88}{117} \times \frac{2}{7} = \frac{176}{819}. \quad 8\frac{4}{5} \times \frac{3}{5} = \frac{74}{5} \times \frac{3}{5} = \frac{74}{15}$$

3

$$\begin{array}{r} 16, 176, 176 \\ 1, 273, 5 \end{array}$$

$$3 \times 273 \times 5 = 4095$$

$$\begin{array}{r} 4095 \\ 14095 \times 16 = 65520 \\ 819 \quad 5 \times 176 = 880 \\ 15 \mid 273 \times 74 = 20202 \end{array}$$

$\frac{65520}{4095}, \frac{880}{4095}, \frac{20202}{4095}$, Ans.

32.

$\frac{252}{14}$.

|

$\frac{190}{18}$.

|

$\frac{477}{3}$.

CASE IX.

2. (p. 105.) $\frac{4}{5} \times \frac{1}{4} \times \frac{1}{12} \times \frac{1}{20} = \frac{1}{1200}$ Ans.

3. $\frac{3}{5} \times \frac{1}{24} \times \frac{1}{20} \times \frac{1}{12} = \frac{3}{28800} = \frac{1}{9600}$ Ans.

4. $\frac{6}{7} \times \frac{1}{2} \times \frac{1}{8} \times \frac{1}{12} = \frac{1}{256}$ Ans.

5. $\frac{3}{11} \times \frac{1}{16} \times \frac{1}{28} \times \frac{1}{4} = \frac{3}{9856}$ Ans.
 $\frac{2}{2}$

6. $\frac{3}{5} \times \frac{1}{24} \times \frac{1}{8} \times \frac{1}{12} = \frac{1}{9600}$ Ans.

7. $\frac{1}{2} \times \frac{1}{24} \times \frac{1}{8} \times \frac{1}{12} = \frac{1}{2304}$ Ans.

8. $\frac{4}{7} \times \frac{1}{12} \times \frac{1}{16} \times \frac{1}{40} \times \frac{1}{8} = \frac{1}{110880}$ Ans.
 $\frac{2}{2}$

9. $\frac{1}{2} \times \frac{1}{2} \times \frac{1}{12} \times \frac{1}{16} \times \frac{1}{40} \times \frac{1}{8} \times \frac{1}{12} = \frac{1}{110880}$ Ans.

10. $\frac{3}{4} \times \frac{1}{144} \times \frac{1}{272} \times \frac{1}{40} \times \frac{1}{8} = \frac{1}{26080560}$ Ans.

11. $\frac{7}{8} \times \frac{1}{4} \times \frac{1}{63} \times \frac{1}{4} = \frac{1}{1152}$ Ans.
 $\frac{9}{9}$

12. $\frac{3}{5} \times \frac{1}{2} \times \frac{1}{8} \times \frac{1}{12} = \frac{1}{320}$ Ans.

13. $\frac{1}{2} \times \frac{1}{8} \times \frac{1}{24} \times \frac{1}{36} = \frac{1}{4207680}$ Ans.

CASE X.

2. (p. 106.) $\frac{1}{1250} \times \frac{2}{1} \times \frac{1}{1} \times \frac{1}{1} = \frac{2}{1250} = \frac{1}{625}$ Ans.
 3. $\frac{1}{625} \times \frac{1}{2} \times \frac{2}{1} \times \frac{1}{1} = \frac{1}{625} = \frac{1}{625}$ Ans.
 4. $\frac{1}{625} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{1} = \frac{1}{1250} = \frac{1}{1250}$ Ans.
 5. $\frac{1}{1250} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{1} = \frac{1}{1250} = \frac{1}{1250}$ Ans.
 6. $\frac{1}{1250} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{1} = \frac{1}{1250} = \frac{1}{1250}$ Ans.
 7. $\frac{1}{250} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{1} = \frac{1}{250} = \frac{1}{250}$ Ans.
 8. $\frac{1}{1250} \times \frac{1}{2} \times \frac{1}{2} \times \frac{16}{1} \times \frac{1}{1} = \frac{1}{1250} = \frac{1}{1250}$ Ans.
 9. $\frac{1}{1250} \times \frac{1}{2} \times \frac{1}{2} \times \frac{16}{1} \times \frac{1}{1} \times \frac{1}{2} = \frac{1}{1250} = \frac{1}{1250}$
 $= \frac{1}{250}$ Ans.
 10. $\frac{1}{1250} \times \frac{1}{2} \times \frac{1}{2} \times \frac{16}{1} \times \frac{2721}{1} \times \frac{1}{1} = \frac{1}{1250} = \frac{1}{1250}$ Ans.
 11. $\frac{1}{1250} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{1} = \frac{1}{1250} = \frac{1}{1250}$ Ans.
 12. $\frac{1}{1250} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{1} = \frac{1}{1250} = \frac{1}{1250}$ Ans.
 13. $\frac{1}{1250} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{1} = \frac{1}{1250} = \frac{1}{1250}$ Ans.

CASE XI.

2. (p. 108.)	3.	4.
u. d.	u. d. qr.	cwt. qr. lb. oz. dr.
1 0	28 0 0	1 0 0 0 0
7	7	7
<u>24) 7 0</u>	<u>9) 196 0 0</u>	<u>11) 7 0 0 0 0</u>
Ans. 3 $\frac{1}{2}$	Ans. 21 9 $\frac{1}{2}$	Ans. 2 15 4 $\frac{5}{12}$
5.	6.	7.
lb. oz. dr.	lb. oz. dwt. gr.	lb. 3. 3. D. gr.
1 0 0	1 0 0 0	1 0 0 0 0
4	8	4
<u>9) 4 0 0</u>	<u>9) 8 0 0 0</u>	<u>13) 4 0 0 0 0</u>
Ans. 7 1 $\frac{1}{2}$	Ans. 10 13 8	Ans. 3 5 1 12 $\frac{4}{12}$

$$\begin{array}{r}
 \text{8.} \\
 \begin{array}{r}
 \text{yd. qr. na. in.} \\
 1 \ 0 \ 0 \ 0 \\
 \hline 7
 \end{array} \\
 13) \underline{7 \ 0 \ 0 \ 0} \\
 \text{Ans. } 2 \ 0 \ 1\frac{1}{3}
 \end{array}
 \qquad
 \begin{array}{r}
 \text{9.} \\
 \begin{array}{r}
 \text{EE. qr. na. in.} \\
 1 \ 0 \ 0 \ 0 \\
 \hline 5
 \end{array} \\
 9) \underline{5 \ 0 \ 0 \ 0} \\
 \text{Ans. } 2 \ 3 \ 0\frac{1}{3}
 \end{array}$$

$$\begin{array}{r}
 \text{10.} \\
 \begin{array}{r}
 \text{m. fur. rd. ft. in.} \\
 1 \ 0 \ 0 \ 0 \ 0 \\
 \hline 11
 \end{array} \\
 13) \underline{11 \ 0 \ 0 \ 0 \ 0} \\
 \text{Ans. } 6 \ 30 \ 12 \ 8\frac{1}{3}
 \end{array}
 \qquad
 \begin{array}{r}
 \text{11.} \\
 \begin{array}{r}
 \text{fur. rd. ft. in.} \\
 1 \ 0 \ 0 \ 0 \\
 \hline 8
 \end{array} \\
 9) \underline{8 \ 0 \ 0 \ 0} \\
 \text{Ans. } 35 \ 9 \ 2
 \end{array}$$

$$\begin{array}{r}
 \text{12.} \\
 \begin{array}{r}
 \text{A. R. p. yd. ft. in.} \\
 1 \ 0 \ 0 \ 0 \ 0 \ 0 \\
 \hline 7
 \end{array} \\
 13) \underline{7 \ 0 \ 0 \ 0 \ 0 \ 0} \\
 \text{Ans. } 2 \ 6 \ 4 \ 5 \ 127\frac{1}{3}
 \end{array}
 \qquad
 \begin{array}{r}
 \text{13.} \\
 \begin{array}{r}
 \text{p. ft. in.} \\
 1 \ 0 \ 0 \\
 \hline 9
 \end{array} \\
 17) \underline{9 \ 0 \ 0} \\
 \text{Ans. } 144 \ 19\frac{1}{3}
 \end{array}$$

$$\begin{array}{r}
 \text{14.} \\
 \begin{array}{r}
 \text{cord. ft. in.} \\
 1 \ 0 \ 0 \\
 \hline 1
 \end{array} \\
 13) \underline{1 \ 0 \ 0} \\
 \text{Ans. } 9 \ 1462\frac{1}{3}
 \end{array}
 \qquad
 \begin{array}{r}
 \text{15.} \\
 \begin{array}{r}
 \text{hhd. gal. qt. pt. gl.} \\
 1 \ 0 \ 0 \ 0 \ 0 \\
 \hline 2
 \end{array} \\
 19) \underline{2 \ 0 \ 0 \ 0 \ 0} \\
 \text{Ans. } 6 \ 2 \ 1 \ 0\frac{1}{3}
 \end{array}$$

$$\begin{array}{r}
 \text{16.} \\
 \begin{array}{r}
 \text{hhd. gal.} \\
 1 \ 0 \\
 \hline 7
 \end{array} \\
 9) \underline{7 \ 0} \\
 \text{Ans. } 42
 \end{array}
 \qquad
 \begin{array}{r}
 \text{17.} \\
 \begin{array}{r}
 \text{year. da. h. m. sec.} \\
 1 \ 0 \ 0 \ 0 \ 0 \\
 \hline 11
 \end{array} \\
 23) \underline{11 \ 0 \ 0 \ 0 \ 0} \\
 \text{Ans. } 174 \ 16 \ 26 \ 5\frac{1}{3}
 \end{array}$$

$$18. \$7\frac{3}{4}\frac{3}{11} = \$7\frac{3}{22}; \frac{11}{11} \times \frac{3}{22} = \frac{1}{22}; \$7\frac{3}{22}.$$

To find the value of $\frac{1}{22}$ of a dollar, we multiply the numerator, 180, by 100, and divide the product by 232; thus, $180 \times 100 = 18000$; $18000 \div 232 = 74\frac{4}{11}$. The answer, therefore, will be $\$7.74\frac{4}{11}$.

CASE XII.

7. (p. 109.) 1s. = 48qr.; $\frac{1}{4}$ d. = 14qr.; $\frac{1}{48}$ = $\frac{1}{24}$ Ans.
8. $\frac{21 \times 12 + 9 = 261 \times 4 + 1 = 1045 \times 3 + 1 = 3136}{26 \times 12 \times 4 \times 3 = 4032} = \frac{1}{6}$ Ans.
9. $\frac{2 \times 28 + 15 = 71 \times 16 + 4 = 1140 \times 16 + 5 = 18945 \times 11 + 9 = 200704}{4 \times 28 \times 16 \times 11 = 31536} = \frac{7}{11}$ Ans.
- = $\frac{7}{11}$ Ans.
10. $\frac{7 \times 16 + 1 = 113 \times 9 + 7 = 1094}{16 \times 18 \times 9 = 2304} = \frac{1}{2}$ Ans.
11. $\frac{10 \times 20 + 13 = 213 \times 24 + 8 = 5120}{18 \times 20 \times 24 = 5760} = \frac{1}{8}$ Ans.
12. $\frac{3 \times 8 + 5 = 29 \times 3 + 1 = 88 \times 20 + 19 = 1779 \times 13 + 4 = 23040}{19 \times 8 \times 3 \times 20 \times 13 = 74880} = \frac{1}{3}$ Ans.
13. $\frac{2 \times 4 = 8 \times 2\frac{1}{4} + 1 = 19 \times 13 + 5 = 252}{4 \times 4 \times 2\frac{1}{4} \times 13 = 468} = \frac{7}{13}$ Ans.
14. $\frac{2 \times 4 + 3 = 11 \times 2\frac{1}{4} = 24 \times 4 + 1 = 100}{5 \times 4 \times 2\frac{1}{4} \times 4 = 160} = \frac{5}{8}$ Ans.
15. $\frac{6 \times 40 + 30 = 270 \times 16\frac{1}{4} + 12 = 4467 \times 19 + 5}{= 53612 \times 3 = 160636 \times 13 + 19} \} = 2090880 = \frac{1}{12}$ Ans.
- $8 \times 40 \times 16\frac{1}{4} \times 19 \times 13 = 2471040$
16. $\frac{35 \times 16\frac{1}{4} + 9 = 586\frac{1}{4} \times 12 + 2 = 7040}{40 \times 16\frac{1}{4} \times 12 = 7920} = \frac{8}{9}$ Ans.
17. $\frac{2 \times 40 + 6 = 88 \times 30\frac{1}{4} + 4 = 26051 \times 9 + 5}{23454 \times 144 + 127 = 3377575 \times 13 + 5} \} = \frac{43906490}{8 \times 40 \times 30\frac{1}{4} \times 9 \times 144 \times 13 = 81544320} = \frac{7}{13}$ Ans.
18. $\frac{144 \times 144 + 19 = 20755 \times 17 + 1 = 352836}{9792 \times 144 \times 17 = 666468} = \frac{8}{17}$ Ans.
19. $\frac{9 \times 1728 + 1482 = 17014 \times 13 + 2 = 221184}{138 \times 1728 \times 13 = 9875392} = \frac{1}{13}$ Ans.
20. $\frac{6 \times 4 + 2 = 26 \times 2 + 1 = 53 \times 4 = 212 \times 19 + 4 = 4039}{63 \times 4 \times 2 \times 4 \times 19 = 38304} = \frac{2}{19}$ Ans.
21. $\frac{\frac{1}{2} \frac{2}{3} = \frac{7}{6}}{\frac{1}{2} \frac{2}{3}}$ Ans.
22. $\frac{174 \times 24 + 16 = 4192 \times 60 + 96 = 251540 \times 60 + 5 = 15092765 \times 23 + 5 = 347133600}{3651 \times 24 \times 60 \times 60 \times 23 = 725894900} = \frac{1}{1}$ Ans.
- = $\frac{1}{1}$ Ans.

SECTION XVII.

ADDITION OF VULGAR FRACTIONS.

CASE I.

6. (p. 110.)	$3\frac{4}{9}$.	9.	$1\frac{2}{3}$.	12.	$1\frac{4}{5}\frac{1}{7}\frac{1}{7}$.
7.	$2\frac{9}{13}$.	10.	$2\frac{4}{5}\frac{4}{7}$.	13.	$2\frac{1}{5}\frac{7}{11}\frac{1}{7}$.
8.	$2\frac{3}{7}$.	11.	$3\frac{3}{8}\frac{3}{7}$.	14.	$2\frac{8}{12}\frac{3}{5}$.

CASE II.

2. (p. 111.)	$2\frac{4}{3}$.	9.	$9\frac{1}{2}\frac{1}{2}$.	17.	$66\frac{1}{7}\frac{1}{7}$.
3.	$1\frac{2}{3}\frac{1}{4}$.	10.	$6\frac{1}{2}$.	18.	$45\frac{1}{2}\frac{1}{8}$.
4.	$2\frac{4}{3}\frac{3}{8}$.	11.	$17\frac{1}{2}\frac{1}{6}$.	19.	$40\frac{1}{4}\frac{1}{6}$.
5.	1.	12.	$9\frac{1}{4}\frac{1}{2}$.	20.	$1068\frac{3}{7}\frac{3}{7}$.
6.	$3\frac{4}{5}\frac{3}{8}$.	13.	$18\frac{1}{3}\frac{1}{3}$.	21.	$12\frac{1}{8}\frac{1}{3}$.
7.	$1\frac{3}{4}\frac{3}{5}$.	15.	$54\frac{1}{2}\frac{1}{2}$.	22.	$13\frac{1}{4}\frac{1}{4}$.
8.	$6\frac{3}{5}\frac{3}{4}$.	16.	96.	23.	$93\frac{1}{4}$.

$$24. \quad 28\frac{3\frac{3}{7}}{4\frac{1}{2}} = 28\frac{27}{30} ; \frac{27}{30} = \frac{27}{7} \times \frac{7}{30} = \frac{9}{10}.$$

$$28\frac{9}{10} = 2\frac{8}{10} ; \frac{1}{2} \times \frac{2}{3} \times \frac{2\frac{8}{10}}{10} = \frac{1}{2}\frac{1}{3}\frac{1}{5} = 2\frac{1}{2}\frac{1}{5}.$$

$$3\frac{1\frac{9}{14}}{10\frac{1}{5}} = 3\frac{7\frac{9}{14}}{10\frac{1}{5}} ; \frac{7\frac{9}{14}}{10\frac{1}{5}} = \frac{7\frac{9}{14}}{10\frac{1}{5}} = 3\frac{7\frac{9}{14}}{10\frac{1}{5}}.$$

$$2\frac{1}{2}\frac{1}{5} + 3\frac{7\frac{9}{14}}{10\frac{1}{5}} = 6\frac{9}{10} \text{ Ans.}$$

$$25. \quad \frac{1}{2} = \frac{1}{2} ; \quad 2\frac{5}{8} = \frac{21}{8} ; \quad \frac{45}{94\frac{1}{11}} = \frac{45}{1041} = \frac{45}{1041} \times \frac{1041}{1041} = \frac{45}{1041} ;$$

$$\frac{47\frac{1}{2}}{314\frac{3}{5}} = \frac{428}{1572} = \frac{428}{8} \times \frac{8}{1572} = \frac{2140}{1572}.$$

$$\frac{1}{2} + \frac{21}{8} + \frac{45}{1041} + \frac{2140}{1572}.$$

$$3) 9, 8, 1041, 14157$$

$$3 \times 8 \times 347 \times 4719 = 39299832 \quad 8, 347, 4719$$

$$\begin{array}{r}
 39299832 \\
 9 \overline{)4366648} \quad 1 = 4366648 \\
 8 \overline{)4912479} \quad 21 = 103162059 \\
 1041 \overline{)37752} \quad 495 = 18687240 \\
 14157 \overline{)2776} \quad 2140 = 5940640 \\
 \\
 \frac{132156587}{39299832} = 3\frac{132156587}{39299832} \text{ Ans.}
 \end{array}$$

CASE IV.

$$\begin{array}{r}
 3. \text{ (p. 114.)} \\
 \frac{7}{12} \text{ of a ton} = 12 \frac{2}{3} \frac{1}{2} \frac{5}{11} \frac{1}{1} \frac{8}{1} \text{ of a yd.} = 2 \frac{1}{1} \frac{1}{2} \frac{7}{11} \\
 \frac{17}{22} \text{ of a cwt.} = 3 \frac{2}{3} \frac{6}{11} \frac{1}{1} \frac{1}{2} \text{ of an E.E.} = 2 \frac{1}{1} \frac{1}{2} \\
 \text{Ans. } 13 \frac{2}{3} 0 \qquad \frac{8}{1} \text{ of a qr.} = 3 \frac{0}{3} \frac{1}{1} \\
 \text{Ans. } 3 \frac{3}{3} 1 \frac{1}{1} \frac{1}{2}
 \end{array}$$

$$\begin{array}{r}
 4. \\
 \frac{7}{11} \text{ of a mile} = 5 \frac{3}{11} \frac{10}{11} \frac{6}{11} \frac{9}{11} \frac{1}{1} \frac{1}{1} \text{ in. bar.} \\
 \frac{17}{13} \text{ of a furlong} = 12 \frac{5}{11} \frac{0}{11} \frac{2}{11} \frac{8}{11} \\
 \frac{9}{22} \text{ of a yard} = 1 \frac{2}{11} \frac{2}{11} \\
 \text{Ans. } 5 \frac{15}{11} \frac{16}{11} \frac{9}{11} \frac{1}{1} \frac{1}{1} \frac{1}{1} = \\
 \text{Ans. } 5 \frac{16}{11} 0 \frac{3}{11} \frac{1}{1} \frac{1}{1}
 \end{array}$$

$$\begin{array}{r}
 5. \\
 \frac{1}{4} \text{ of an A.} = 0 \frac{2}{4} \frac{34}{4} \frac{77}{4} \frac{113}{4} \\
 \frac{3}{4} \text{ of an A.} = 0 \frac{2}{4} \frac{26}{4} \frac{181}{4} \frac{72}{4} \\
 \frac{11}{12} \text{ of an A.} = 0 \frac{3}{4} \frac{28}{4} \frac{155}{4} \frac{82}{4} \\
 \text{Ans. } 2 \frac{1}{4} \frac{9}{4} \frac{141}{4} \frac{123}{4} = \\
 \text{Ans. } 2 \frac{1}{4} \frac{9}{4} \frac{142}{4} \frac{67}{4}
 \end{array}$$

$$\begin{array}{r}
 6. \\
 18 \frac{3}{4} \text{ miles} = 18 \frac{3}{4} \frac{17}{4} \frac{2}{4} \frac{42}{4} \\
 23 \frac{6}{11} \text{ miles} = 23 \frac{6}{11} \frac{11}{11} \frac{7}{11} \frac{0}{11} \\
 19 \frac{0}{11} \text{ miles} = 19 \frac{0}{11} \frac{15}{11} \frac{3}{11} \frac{11}{11} \\
 \text{Ans. } 61 \frac{2}{4} \frac{3}{4} \frac{13}{4} \frac{42}{4}
 \end{array}$$

$$\begin{array}{r}
 7. \\
 \frac{1}{2} \text{ of a gal.} = 0 \frac{3}{2} \frac{1}{2} \frac{1}{2} \frac{1}{2} \frac{1}{2} \\
 \frac{17}{22} \text{ of a hhd.} = 5 \frac{1}{2} \frac{0}{2} \frac{0}{2} \\
 \text{Ans. } 6 \frac{0}{2} \frac{1}{2} \frac{1}{2} \frac{5}{2}
 \end{array}
 \qquad
 \begin{array}{r}
 8. \\
 \frac{5}{6} \text{ of a week} = 2 \frac{4}{6} \frac{30}{6} \\
 \frac{1}{6} \text{ of a day} = 4 \frac{48}{6} \\
 \text{Ans. } 2 \frac{9}{6} \frac{18}{6}
 \end{array}$$

	ft.	in.		ft.	in.
$\frac{1}{4}$ of a square ft. =	0	108		11	16
$\frac{1}{2}$ a foot square =		36			6
Ans. 1		0		11	16
			Ans. 12	0	5
				11	=

SECTION XVIII.

SUBTRACTION OF VULGAR FRACTIONS.

CASE I.

6. (p. 115.)	$1\frac{7}{17}$.	11.	$1\frac{5}{17}$.	16.	$1\frac{5}{17}$.
7.	$1\frac{9}{19}$.	12.	$1\frac{1}{19}$.	17.	$1\frac{1}{19}$.
8.	$1\frac{1}{17}$.	13.	$1\frac{3}{17}$.	18.	$1\frac{6}{17}$.
9.	$1\frac{3}{19}$.	14.	$1\frac{1}{19}$.	19.	$1\frac{6}{19}$.
10.	$1\frac{5}{19}$.	15.	$1\frac{1}{19}$.		

CASE II.

5. (p. 116.)	$1\frac{3}{8}$.	10.	$1\frac{2}{3}\frac{1}{8}$.	15.	$1\frac{5}{8}$.
6.	$1\frac{7}{2}$.	11.	$1\frac{2}{3}\frac{1}{2}$.	16.	$1\frac{3}{2}$.
7.	$1\frac{1}{2}$.	12.	$1\frac{2}{3}\frac{1}{2}$.	17.	$1\frac{2}{3}$.
8.	$1\frac{3}{4}$.	13.	$1\frac{1}{4}$.	18.	$1\frac{1}{4}$.
9.	$1\frac{7}{6}$.	14.	$1\frac{3}{6}$.	19.	$1\frac{1}{2}$.

CASE III.

8. (p. 117.)	$5\frac{1}{4}$.	10.	$78\frac{9}{23}$.	12.	$30\frac{1}{3}$.
9.	$18\frac{4}{7}$.	11.	$680\frac{9}{14}$.	13.	$31\frac{8}{9}$.

$$\begin{array}{lll} 18\frac{16}{21} = 18\frac{4}{7} & 73\frac{17}{21} = 73\frac{1}{3} & 67\frac{18}{21} = 67\frac{1}{3} \\ 9\frac{9}{7} = 9\frac{4}{7} & 16\frac{14}{21} = 16\frac{4}{7} & 16\frac{16}{21} = 16\frac{4}{7} \\ 8\frac{4}{7} \text{ Ans.} & 56\frac{4}{7} \text{ Ans.} & 50\frac{2}{3} \text{ Ans.} \end{array}$$

$$\begin{array}{lll} 29\frac{19}{21} = 29\frac{4}{7} & 144\frac{20}{21} = 144\frac{4}{7} & 171\frac{21}{21} = 171\frac{4}{7} \\ 15\frac{15}{21} = 15\frac{7}{7} & 99\frac{19}{21} = 99\frac{4}{7} & 91\frac{21}{21} = 91\frac{4}{7} \\ 14\frac{6}{7} \text{ Ans.} & 44\frac{4}{7} \text{ Ans.} & 79\frac{4}{7} \text{ Ans.} \end{array}$$

$$\begin{array}{rcl} \text{22.} & & \text{23.} \\ 101\frac{1}{2} = 101\frac{3}{8} & 165\frac{1}{2} = 165\frac{8}{3} & 77\frac{1}{2} = 77\frac{2}{3} \\ 93\frac{3}{4} = \underline{93\frac{3}{4}} & 98\frac{1}{2} = \underline{98\frac{1}{2}} & 19\frac{1}{2} = \underline{19\frac{1}{2}} \\ 8\frac{3}{5} \text{ Ans.} & 66\frac{1}{2} \text{ Ans.} & 57\frac{1}{2} \text{ Ans.} \end{array}$$

$$\begin{array}{rcl} \text{25.} & & \text{26.} \\ 84\frac{3}{4} = 84\frac{7}{8} & 671\frac{1}{2} = 671\frac{2}{3} & 17\frac{1}{2} = 17\frac{3}{2} \\ 15\frac{1}{2} = \underline{15\frac{1}{2}} & 183\frac{3}{4} = \underline{183\frac{3}{4}} & 8\frac{1}{2} = \underline{8\frac{1}{2}} \\ 69\frac{1}{2} \text{ Ans.} & 487\frac{1}{2} \text{ Ans.} & \text{Ans. } 8\frac{1}{2} \end{array}$$

$$\begin{array}{rcl} \text{28.} & & \text{29.} \\ 63 & 30 & 17\frac{1}{2} = 17\frac{3}{8} \\ \underline{7\frac{9}{11}} & \underline{5\frac{7}{12}} & \underline{28\frac{7}{12}} = 28\frac{5}{8} \\ 55\frac{2}{11} \text{ Ans.} & 24\frac{7}{12} \text{ Ans.} & 46\frac{5}{8} \text{ Ans.} \\ & & 97\frac{1}{4} \text{ Ans.} \end{array}$$

$$\begin{array}{rcl} \text{31.} & & \text{32.} \\ 34 & \frac{2}{11} \times \frac{4}{1} = \frac{8}{11} = 4\frac{4}{11} & 40 \\ \underline{9\frac{7}{11}} & \frac{2}{11} \times \frac{4}{1} = \frac{8}{11} = \underline{7\frac{1}{11}} & \underline{11\frac{8}{11}} \\ 24\frac{1}{11} \text{ Ans.} & & 11\frac{8}{11} \text{ Ans.} \\ & & 28\frac{1}{11} \text{ Ans.} \end{array}$$

$$\begin{array}{l} \text{33.} \\ \frac{1}{2} \times \frac{9}{4} = \frac{9}{8} = 2\frac{1}{4} \text{ feet.} \\ \frac{1}{2} \times \frac{1}{6} = \frac{1}{12}; \frac{1}{12} \times \frac{9}{4} = \frac{9}{48} = \frac{1}{5} \text{ foot.} \\ 2\frac{1}{4} - \frac{1}{5} = 2 \text{ feet, Ans.} \end{array}$$

$$\begin{array}{l} \text{34.} \\ \frac{49\frac{5}{8}}{97} = \frac{397}{97} = \frac{397}{97} \times \frac{1}{97} = \frac{397}{9409}. \\ \frac{34\frac{3}{8}}{145\frac{1}{11}} = \frac{173}{145} = \frac{173}{145} \times \frac{1}{145} = \frac{173}{21025}. \\ \frac{397}{9409} - \frac{173}{21025} = \frac{847854}{3100025} \text{ Ans.} \end{array}$$

NOTE. A square yard is 9 square feet; and $\frac{1}{4}$ of 9 feet is $2\frac{1}{4}$ feet. $\frac{1}{12}$ of a yard in length is 6 inches, and the square of 6 inches is 36 inches. 36 inches are $\frac{1}{4}$ of a square foot. Thus, $\frac{36}{144} = \frac{1}{4}$ foot. This fourth we subtract from $2\frac{1}{4}$ feet. Thus, $2\frac{1}{4} - \frac{1}{4} = 2$ feet, Ans.

CASE V.

	3. (p. 120.)			4.			
	qr.	na.	in.	fur.	rd.	ft.	in.
$\frac{7}{8}$ E.E.	= 4	1	$1\frac{1}{8}$	$\frac{2}{3}$ of a mile	= 1	31	1 10
$\frac{2}{3}$ of a yd.	= 1	0	$1\frac{1}{2}$	$\frac{7}{11}$ of a fur.	=	25	7 6
Ans. 3	0	2	$2\frac{5}{8}$			1	5 10 $\frac{1}{2}$ 4 =
						Ans. 1	5 10 10 10

$$\begin{array}{r} \frac{5}{8} \text{ deg.} = 49 \frac{5}{5} \frac{5}{5} \frac{11}{11} \frac{9}{9} \frac{1\frac{1}{2}}{1\frac{1}{2}} \\ \frac{5}{8} \text{ mile} = 4 \frac{32}{32} \frac{0}{0} \frac{0}{0} \\ \hline \text{Ans. } 49 & 0 & 13 & 11 & 9 & 1\frac{1}{2} \end{array}$$

$$\begin{array}{r} \frac{R}{A} = 1 \frac{18}{18} \frac{5}{5} \frac{4}{4} \frac{72}{72} \\ \frac{1}{8} \text{ rod} = 0 \quad 0 \quad 13 \quad 4 \quad 0 \\ \hline 1 & 17 & 22\frac{1}{4} & 0 & 72 \\ & & \frac{1}{4} & 2 & 36 \\ \hline \text{Ans. } 1 & 17 & 22 & 2 & 108 \end{array} \quad \begin{array}{r} \frac{7}{10} \text{ cord} = 115 \frac{7}{7} \frac{345\frac{1}{2}}{471\frac{3}{4}} \\ \frac{2}{11} \text{ cord} = 23 \frac{2}{2} \frac{471\frac{3}{4}}{471\frac{3}{4}} \\ \hline \text{Ans. } 91 & 1602\frac{1}{8} \end{array}$$

$$\begin{array}{r} \frac{7}{8} \text{ hhd.} = 33 \frac{3}{3} \frac{1}{1} \frac{1\frac{1}{2}}{1\frac{1}{2}} \\ \frac{1}{8} \text{ of } \frac{7}{8} \text{ hhd.} = 27 \frac{0}{0} \frac{1}{1} \frac{0\frac{1}{2}}{0\frac{1}{2}} \\ \hline \text{Ans. } 6 & 3 & 0 & 1\frac{1}{2} \end{array}$$

$$\begin{array}{r} \frac{9}{72} \text{ m.} = 72 \frac{0}{0} \frac{0}{0} \frac{0}{0} \frac{0}{0} \\ \frac{1}{8} \text{ of } 72 \text{ m.} = 41 \frac{1}{1} \frac{5}{5} \frac{11}{11} \frac{9}{9} \frac{1\frac{1}{2}}{1\frac{1}{2}} \\ \hline 30 & 6 & 34 & 4\frac{1}{2} & 2 & 1\frac{1}{2} \\ & & & \frac{1}{2} & 6 & 0 \\ \hline \text{Ans. } 30 & 6 & 34 & 4 & 8 & 1\frac{1}{2} \end{array}$$

$$\begin{array}{r} \frac{10}{\frac{1}{8} \text{ year}} = 104 \frac{8}{8} \frac{34}{34} \frac{17\frac{1}{2}}{17\frac{1}{2}} \\ \frac{1}{8} \text{ week} = 3 \frac{2}{2} \frac{40}{40} \frac{0}{0} \\ \hline \text{Ans. } 101 & 5 & 54 & 17\frac{1}{2} \end{array} \quad \begin{array}{r} \frac{11}{\frac{1}{8} A} = 1 \frac{18}{18} \frac{5}{5} \frac{4}{4} \frac{72}{72} \\ \frac{1}{8} \text{ ft.} = \\ \hline \text{Ans. } 1 & 18 & 5 & 4 & 0 \end{array}$$

SECTION XIX.

MULTIPLICATION OF VULGAR FRACTIONS.

CASE I.

$$\begin{array}{r} 2. \text{ (p. 121.) } \frac{8}{3} \cdot | 4. \qquad \qquad \qquad \frac{24}{7} \cdot | 6. \qquad \qquad \qquad \frac{24}{7} \cdot \\ 3. \qquad \frac{5}{14} \cdot | 5. \qquad \qquad \qquad \frac{77}{172} \cdot | 7. \qquad \qquad \qquad \frac{55}{172} \cdot \end{array}$$

8.	$\frac{4}{5}$	12.	$\frac{8}{15}$	14.	$\frac{7}{15}$
10.	$\frac{1}{3}$	13.	$\frac{2}{3}$	15.	$\frac{1}{10}$
11.	$\frac{3}{5}$				

CASE II.

2. (p. 122.)	$8\frac{4}{5}$	7.	$12\frac{2}{5}$	13.	$3\frac{4}{5}$
3.	$8\frac{1}{4}$	8.	$7\frac{1}{2}$	14.	$89\frac{1}{2}$
4.	$4\frac{8}{5}$	9.	$21\frac{1}{5}$	15.	$816\frac{2}{3}$
5.	$3\frac{3}{4}$	10.	$6\frac{1}{4}$	16.	$835.$
6.	$16\frac{8}{5}$	12.	$12\frac{1}{2}$		

CASE III.

2. (p. 123.)	$60\frac{1}{4}$	16.	$\$ 40.18\frac{4}{12}$	30.	$8\frac{1}{4}$
3.	$75\frac{3}{4}$	17.	$\$ 2.78\frac{3}{4}$	31.	$8\frac{1}{4}$
4.	$82\frac{1}{4}$	18.	$\$ 1.91\frac{1}{4}$	32.	$\frac{7}{3}$
5.	$108\frac{9}{10}$	19.	$\$ 343.73\frac{4}{5}$	33.	$39\frac{4}{5}$
6.	$131\frac{1}{2}$	20.	$\$ 140.56$	34.	$49\frac{1}{3}\frac{3}{4}$
7.	$257\frac{9}{10}$	22.	$3136\frac{4}{5}$	35.	$26\frac{4}{5}$
8.	$709\frac{1}{11}$	23.	$3\frac{1}{4}$	36.	$25\frac{1}{4}\frac{1}{5}$
9.	$679\frac{1}{2}$	24.	$15\frac{6}{11}$	37.	$299\frac{1}{2}\frac{1}{4}$
10.	$16294.$	25.	$63\frac{3}{4}\frac{7}{5}$	38.	$20\frac{8}{7}\frac{9}{5}$
11.	$\$ 1.91.$	26.	$78\frac{1}{4}$	39.	$\$ 394\frac{1}{4}$
12.	$\$ 1.88\frac{1}{4}$	27.	$403\frac{1}{5}$	40.	$\$ 256\frac{6}{7}\frac{4}{5}$
13.	$\$ 32.94\frac{3}{5}$	28.	$26\frac{1}{4}$	41.	$\$ 11\frac{3}{2}$
14.	$\$ 79.00.$	29.	$6\frac{1}{2}$	42.	$\$ 3\frac{1}{4}$
15.	$\$ 1703.56\frac{4}{5}$				

$$\frac{27}{37\frac{1}{2}} = \frac{\frac{27}{1}}{\frac{189}{12}} = \frac{27}{1} \times \frac{5}{189} = \frac{5}{7}$$

$$\frac{87\frac{3}{5}}{98\frac{1}{5}} = \frac{\frac{875}{5}}{\frac{490}{5}} = \frac{875}{490} \times \frac{8}{875} = \frac{8}{49}$$

$$\frac{\frac{1}{2}}{2\frac{1}{3}} = \frac{\frac{1}{2}}{\frac{7}{3}} = \frac{1}{2} \times \frac{3}{7} = \frac{3}{14}$$

$$\frac{81\frac{5}{7}}{128} = \frac{\frac{566}{7}}{128} = \frac{896}{11} \times \frac{1}{128} = \frac{7}{11}$$

$$\frac{5}{7} \times \frac{8}{9} \times \frac{3}{8} \times \frac{7}{11} = \frac{5}{33} \text{ Ans.}$$

SECTION XX.

DIVISION OF VULGAR FRACTIONS.

CASE I.

2. (p. 125.)	$1\frac{7}{8}$.	5.	$9\frac{1}{5}$.	8.	$100\frac{2}{3}$.
3.	$8\frac{1}{5}$.	6.	$1\frac{1}{5}\frac{1}{5}$.	9.	$1\frac{9}{10}\frac{1}{5}$.
4.	$4\frac{1}{5}$.	7.	$1\frac{1}{8}\frac{1}{7}$.	10.	$2\frac{1}{2}\frac{1}{5}$.

CASE II.

2. (p. 126.)	$28\frac{4}{7}$.	5.	960.	8.	$200\frac{2}{3}$.
3.	$41\frac{1}{15}$.	6.	$151\frac{5}{11}$.	9.	$88\frac{1}{3}$.
4.	459.	7.	$31\frac{3}{14}$.	10.	225.

CASE III.

2. (p. 126.)	$3\frac{2}{3}$.	6.	\$ $4\frac{1}{3}$.	10.	\$ $5.65\frac{1}{3}$.
3.	$2\frac{1}{4}$.	7.	\$ $8\frac{2}{3}$.	11.	\$ $0.21\frac{1}{2}$.
4.	$1\frac{4}{3}$.	8.	$20\frac{1}{2}\frac{1}{2}$ cwt.	12.	\$ $0.31\frac{1}{8}$.
5.	$2\frac{1}{3}$.	9.	\$ $125.63\frac{3}{4}$.	13.	19 $\frac{1}{2}\frac{1}{4}$ acres.

CASE IV.

9. (p. 128.)	$1\frac{2}{3}$.	15.	$7\frac{3}{5}$.	21.	$1\frac{1}{3}$.
10.	$1\frac{7}{8}$.	16.	$7\frac{1}{3}\frac{1}{7}$.	22.	$3\frac{1}{3}\frac{1}{3}$.
11.	$\frac{1}{3}\frac{1}{6}$.	17.	20.	23.	$7\frac{1}{3}\frac{1}{9}$.
12.	$1\frac{1}{10}\frac{1}{5}$.	18.	$1\frac{1}{3}\frac{1}{3}$.	24.	\$ 50.
13.	$1\frac{6}{5}$.	19.	\$ $1\frac{1}{3}\frac{1}{3}$.	25.	\$ 158 $\frac{1}{3}$.
14.	$11\frac{1}{3}$.	20.	$11\frac{1}{2}\frac{1}{4}\frac{1}{11}$.		

SECTION XXI.

QUESTIONS TO BE PERFORMED BY ANALYSIS.

3. (p. 129.) $30\frac{4}{5} = \frac{154}{5}$; $17\frac{2}{5} \times \frac{15}{5} = \frac{25920}{25}$; $7\frac{1}{5} = \frac{36}{5}$; $\frac{25920}{25} \times \frac{36}{5} = \frac{926080}{125} = \$ 432$ Ans.
4. $7\frac{1}{5} = \frac{36}{5}$; $\frac{132}{5} \times \frac{36}{5} = \frac{4752}{25}$; $17\frac{2}{5} \times \frac{4752}{25} = \frac{82224}{25} = 30\frac{4}{5}$ tons, Ans.
5. $7\frac{1}{5} = \frac{36}{5}$; $\frac{132}{5} \times \frac{36}{5} = \frac{12960}{25}$; $30\frac{4}{5} = \frac{154}{5}$; $\frac{154}{5} \times \frac{12960}{25} = \frac{6883840}{125} = \$ 1728$ Ans.
6. $30\frac{4}{5} = \frac{154}{5}$; $17\frac{2}{5} \times \frac{15}{5} = \frac{25920}{25}$; $\frac{132}{5} \times \frac{25920}{25} = 7\frac{1}{5}$ tons, Ans.
7. $7\frac{1}{5} = \frac{36}{5}$; $6\frac{1}{2} = \frac{13}{2}$; $\frac{13}{2} \times \frac{36}{5} = \frac{468}{5} = 49\frac{3}{5}$ bushels, Ans.
8. $\frac{7}{11}$ of $17 = \frac{119}{11} = 10\frac{9}{11}$; $10\frac{9}{11} + 15 = 25\frac{9}{11} = \frac{284}{11}$; $17\frac{2}{5} \times \frac{11}{11} = \frac{18041}{25} = \$ 66\frac{9}{25}$, each girl's share; $\frac{7}{11}$ of $66\frac{9}{25} = \frac{7}{11} \times \frac{18041}{25} = \frac{12629}{25} = \$ 424\frac{1}{25}$, each boy's share.
9. $14\frac{4}{5} \times \frac{9}{7} = \frac{13041}{35} = 18.63$; $4\frac{3}{7} = \frac{31}{7}$; $18\frac{6}{7} \times \frac{31}{7} = \frac{57753}{49} = \$ 82.50\frac{3}{7}$ Ans.
10. $82.50\frac{3}{7} = \frac{57753}{49}$; $4\frac{3}{7} = \frac{31}{7}$; $\frac{57753}{49} \times \frac{7}{31} = \frac{104371}{217} = 18.63$; $\frac{104371}{217} = \frac{7}{5}$ Ans.
11. $14\frac{4}{5} \times \frac{9}{7} = \frac{13041}{35} = 18.63$; $82.50\frac{3}{7} \div 18.63 = 4\frac{3}{7}$ Ans.
12. $82.50\frac{3}{7} = \frac{57753}{49}$; $4\frac{3}{7} = \frac{31}{7}$; $\frac{57753}{49} \times \frac{7}{31} = \frac{104371}{217} = 18.63$; $\frac{7}{5}$ of $18\frac{6}{7} = \frac{13041}{35} = \$ 14.49$ Ans.
13. $14\frac{4}{5} = \frac{119}{5}$; $\frac{119}{5} \times \frac{9}{15} = \frac{4009}{25}$; $9\frac{1}{2} = \frac{119}{12}$; $\frac{4009}{25} \times \frac{119}{12} = \frac{476009}{300} = \$ 333.33\frac{1}{3}$ Ans.
14. $9\frac{1}{2} = \frac{119}{12}$; $333.33\frac{1}{3} = \frac{100000}{3}$; $\frac{100000}{3} \times \frac{119}{12} = \frac{1290000}{36} = 14290000$; $14290000 \times \frac{119}{6} = \frac{16500000}{6} = \$ 500$ Ans.
15. $333.33\frac{1}{3} = \frac{100000}{3}$; $9\frac{1}{2} = \frac{119}{12}$; $\frac{100000}{3} \times \frac{119}{12} = \frac{1290000}{36} = 14290000$; $\frac{500000}{1200000} \times \frac{357}{1} = \frac{1785}{120} = 14\frac{5}{8}$ tons, Ans.
16. $14\frac{4}{5} = \frac{119}{5}$; $\frac{100000}{3} \times \frac{119}{5} = \frac{1000000}{15}$; $333.33\frac{1}{3} = \frac{100000}{3}$; $\frac{100000}{3} \times \frac{119}{6} = \frac{11900000}{18} = 9\frac{1}{2}$ tons, Ans.

17. $97\frac{1}{4} = 97.25$; $97.25 \times 7\frac{8}{3} = 244.36 = .32$; $763\frac{1}{4} \times .32$
 $= \$244.36$ Ans.
18. $763\frac{1}{4} = 763.25$; $763.25 \times 7\frac{8}{3} = 1954.81 = .32$; $97\frac{1}{4}$
 $\times .32 = \$31.32$ Ans.
19. $763\frac{1}{4} = 763.25$; $763.25 \times 7\frac{8}{3} = 1954.81 = .32$; 31.32
 $\div .32 = 97\frac{1}{4}$ gal. Ans.
20. $1975 \div 40 = 49\frac{3}{4}$; $49\frac{3}{4} \times 144 = 7110$ lb. Ans.
21. $15.75 \div 17 = 92\frac{1}{14}$; $92\frac{1}{14} = 147\frac{1}{14}$; $9\frac{1}{4} = 97\frac{1}{4}$; $147\frac{1}{14} \times$
 $97\frac{1}{4} = 1427.5 = \88.56 Ans.
22. $50\frac{1}{4} = 50.25$; $\frac{1}{3} \times 50.25 = 16.75$; $87\frac{1}{2} = 87.5$; 16.75×87.5
 $= 1450.625 = \$492.5$ Ans.
23. $78 \times 13 = 1014$; $13 + 7 = 20$; $1014 \div 20 = 50\frac{7}{10}$
 days, Ans.
24. $10 \times 9 = 90$; $90 \div 15 = 6$ days, Ans.
25. $15 \times 6 = 90$; $90 \div 10 = 9$ days, Ans.
26. $10 \times 9 = 90$; $90 \div 6 = 15$ hours, Ans.
27. $17\frac{1}{11} = 17.0909$; $5\frac{3}{7} = 5.42857$; $5.42857 \times 17.0909 = 92.3076923$; $97\frac{1}{4} = 97.25$;
 $17.0909 \times 97.25 = 1670.04 = \303.75 Ans.
28. $9\frac{1}{2} = 9.5$; $19\frac{1}{2} = 19.5$; $19.5 \times 1.5 = 29.25 = 189\frac{1}{4}$;
 $189\frac{1}{4} + 7 = 196\frac{1}{4}$; $9\frac{1}{2}$ tons = 192 cwt.; $196\frac{1}{4} \div 192 = \1.25 Ans.
29. $9\frac{1}{2}$ tons = 192 cwt.; $192 \times 1\frac{1}{4} = 336$; $336 - 7 = \$329$, Ans.
30. $47\frac{3}{11} = 47.2727$; $2\frac{2}{3} = 2.6666$; $47.2727 \times 2.6666 = 126.3333$; $0.75 = \frac{3}{4}$; $126.3333 \div \frac{3}{4} = 168\frac{1}{3}$ bushels, Ans.
31. $57\frac{9}{11} = 57.818181$; $57.818181 \times 1\frac{1}{5} = 69.3818181$; $19\frac{1}{8} = 19.125$; $69.3818181 \times 19.125 = 1324.125 = \76.125 Ans.
32. $19\frac{7}{8} = 19.875$; $76\frac{6}{11} = 76.545454$; $19.875 \times 76.545454 = 1500000$
 $= 1500000 = 15$ cords, Ans.
33. $7\frac{3}{10} = 7.3$; $47\frac{1}{3} = 47.3333$; $47.3333 \times 7.3 = 345.3333 = 345\frac{1}{3}$ s.
 $= 17\mathcal{E}. 5s. 6\frac{2}{3}$ d. Ans.
34. $172\mathcal{E}. 15s. 0\frac{2}{3}d. = 172.15 \times 1.3333 = 227.302 \times 1.3333$
 $= 302.16666666666666 = 875\frac{1}{3}$ d. = 3£. 12s. 11\frac{2}{3}d. Ans.
35. $43\frac{6}{7} = 43.857142857142857$; $3\frac{2}{7} = 3.42857142857142857$; $2\frac{1}{8} = 2.125$
 $= \$23.6173$ Ans.
36. $17\frac{3}{8} = 17.375$; $2\frac{1}{11} = 2.0909090909090909$; $2\frac{2}{9} = 2.2222222222222222$; $2.2222222222222222 \times 17.375 = 38.809375 = \7.581944 Ans.

37. $87\frac{3}{4} = 8.42$; $8.42 \times 7 = 59.94$; $14\frac{7}{10} \times 7 = \102.90 Ans.
38. $\frac{4375}{100} \times \frac{8}{5} = \frac{35000}{50} = 50$; $50 \times 10 = \$500$ Ans.
39. $500 \div 10 = 50$; $\frac{50}{4375} = \frac{1}{8}$ acre, Ans.
40. $71.87 \div 9 = 7.98\frac{1}{9} = 7.98\bar{1}$; $\frac{1}{9} \times 25 = \frac{25}{9} = \$4.56\bar{2}$ Ans.
41. $4.56\bar{2} \times \frac{1}{4} = 1.16\bar{5}$; $7.98\bar{1} \times 9 = \$71.87$ Ans.
42. $111 \times 19 = 2109$; $2109 \div 47 = 44\frac{1}{4}$ days, Ans.
43. $44\frac{1}{4} \times 47 = 2109$; $2109 \div 19 = 111$ days, Ans.
44. $\frac{23}{10} \times \frac{11}{4} = \frac{101}{40} = 25.30$; $25.30 \times 17 = \$430.10$ Ans.
45. $430.10 \div 17 = 25.30$; $\frac{1}{17} \times \frac{23}{10} = \frac{101}{170} = \9.20 Ans.
46. $11\frac{1}{5} \times 16 = 114\frac{10}{5} = 16.34\bar{3}$; $16.34\bar{3} \times 7 = \114.40 Ans.
47. $\frac{7}{5} \times \frac{11440}{10} = \frac{11440}{5} = \7.15 Ans.
48. $8\frac{1}{2} = \frac{17}{2}$; $11\frac{1}{4} = \frac{45}{4}$; $\frac{17}{2} \times \frac{45}{4} = \frac{765}{8} = \frac{95}{16}$ days, Ans.
49. $19 \div 4 = 4\frac{3}{4}$; $25 \times 4\frac{3}{4} = \118.75 Ans.
50. $87.25 \div 15 = 5.81\bar{3}$; $5.81\bar{3} \times 100 = \$581.66\bar{3}$ Ans.
51. $81.75 \div 20 = 4.08\bar{2}$; $4.08\bar{2} \times 70 = \$286.12\bar{4}$ Ans.
52. $19\frac{7}{12} = \frac{235}{12}$; $\frac{197}{2} \times \frac{235}{12} = \frac{46425}{24} = \$193.38\bar{4}$ Ans.
53. $47.25 \div 3 = 15.75$; $15.75 \times 11\frac{1}{2} = \$179.81\bar{4}$ Ans.
54. $\frac{19}{4} \times \frac{1}{5} = \frac{19}{20} = \$5.314\bar{5}$ Ans.
55. $13\frac{2}{3} = \frac{41}{3}$; $\frac{300}{7} \times \frac{41}{3} = \frac{2780}{7} = \$209.77\bar{5}\bar{9}$ Ans.
56. $\frac{1}{4} = \frac{3}{12}$; $1\frac{1}{2} \times \frac{3}{12} = \frac{9}{12} = 120$ feet, Ans.
57. $20 \times 8 = 160$; $160 \div 12 = 13\frac{1}{3}$ days, Ans.
58. $5 \times 10 \times 23 = 1150$ hours; $1150 \div 46 = 25$ hours;
 $25 \text{ hours} \div 8 = 3\frac{1}{4}$ days, Ans.
59. Smith will reap $\frac{1}{5}$ of the field in an hour; his wife will reap $\frac{1}{10}$ of the field in an hour. They will both reap $\frac{1}{5} + \frac{1}{10} = \frac{3}{10}$ of the field in an hour. Then they will reap the whole field in $\frac{10}{3}$ hours = $45\frac{1}{3}$; $45\frac{1}{3} \div 8 = 5\frac{3}{4}$ days, Ans.
60. 15 tons 7 cwt. 2 qr. 18 lb. = 34458 lb.; $\$2067.48 \div 34458 = 6$ cents per lb.; 1 ton = 2240 lb.; $2240 \times 6 = \$134.40$ per ton; $\$134.40 \times 78 = \10483.20 Ans.

61. $9\frac{7}{8} = 9.875 = 10\frac{7}{8}$; $\frac{1}{87} \times 10\frac{7}{8} = \frac{1075}{874}$; $10\frac{7}{8} \times \frac{174}{1075} = 12\frac{853}{875} = 650\frac{88}{875}$ miles, Ans.
62. $\frac{1}{8} \times 96\frac{3}{4} = 60\frac{3}{4}$; $96\frac{3}{4} - 60\frac{3}{4} = 36\frac{3}{4}$; $36\frac{3}{4} \div 2 = 18\frac{3}{8}$ yards, Ans.
63. $\frac{1}{2} + \frac{1}{2} = \frac{2}{2}$, horse and chaise; $\frac{2}{2} = \$250$; $250 \div 23 = 10\frac{20}{23}$; $10\frac{20}{23} \times 12 = \$130\frac{10}{23}$, horse; $10\frac{20}{23} \times 11 = \$119\frac{12}{23}$, chaise; $\frac{1}{11} \times 130\frac{10}{23} = \$83\frac{1}{23}$, harness.
64. $\frac{1}{4} \times \frac{1}{4} = \frac{1}{16}$ a bushel; $17\frac{5}{8} = 14\frac{1}{8}$; $14\frac{1}{8} \times \frac{1}{16} = \frac{287}{128} = 30\frac{7}{128}$ bushels, Ans.
65. $2\frac{3}{4} = 17$; $17\frac{5}{8} = 12\frac{3}{8}$; $12\frac{3}{8} \times \frac{7}{17} = \frac{123}{17} = 7\frac{4}{17}$. A. Ans.
66. $17\frac{5}{8} = 12\frac{3}{8}$; $7\frac{5}{8} = 12\frac{3}{8}$; $12\frac{3}{8} \times \frac{17}{12} = 17 = 2\frac{3}{4}$ bu. Ans.
67. $1.37\frac{1}{2} \times 47\frac{3}{4} = 65.65\frac{3}{8}$; $176.18 - 65.65\frac{3}{8} = 110.52\frac{5}{8}$
 $= 110\frac{41}{64}$; $2\frac{3}{4} = 2.42\frac{3}{8} = 17\frac{10}{64}$; $110\frac{41}{64} \times 17\frac{10}{64} = 18837\frac{3}{64} = 45.69\frac{23}{64}$ bushels, Ans.
68. $8\frac{1}{4} = 4\frac{1}{2}$; $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$; $\$1.17\frac{3}{4}$ Ans.
69. $18\frac{3}{4} = 18\frac{1}{4}$; $21\frac{1}{4} \times \frac{1}{18\frac{1}{4}} = 1\frac{1}{18\frac{1}{4}}$; $\frac{1}{4} = \frac{1}{4}$; $1\frac{1}{18\frac{1}{4}} \times \frac{1}{4} = \frac{1}{18\frac{1}{4}} = 8.919\frac{17}{820}$ Ans.
70. $17\frac{5}{8}$. 8s. 11d. = 4187d.; $9\frac{3}{4} = 10\frac{1}{4}$; $4187 \times \frac{1}{10\frac{1}{4}} = 418\frac{1}{2}\frac{1}{4}$; $19\frac{5}{8} = 19\frac{1}{4}$; $418\frac{1}{2}\frac{1}{4} \times 19\frac{1}{4} = 830\frac{800}{14}$ = 88374\frac{1}{4}d. = 36£. 16s. 5\frac{3}{4}d. Ans.
71. $756\frac{4}{11} = 8\frac{12}{11}$; $7\frac{3}{11} = 4\frac{1}{11}$; $8\frac{12}{11} \times \frac{1}{4\frac{1}{11}} = \frac{110}{45} = 100$ garments, Ans.
72. $18\frac{1}{4} = 18\frac{9}{4}$; $\frac{9000}{18\frac{9}{4}} \times \frac{1}{18\frac{9}{4}} = \frac{9000}{330}$; $171\frac{3}{4} = 17\frac{7}{4}$; $\frac{9000}{330} \times \frac{17\frac{7}{4}}{18\frac{9}{4}} = \frac{8637300}{3648} = \$830.50\frac{25}{32}$ Ans.
73. $147\frac{3}{11} = 16\frac{2}{11}$; $36\frac{3}{4} = 3\frac{1}{4}$; $16\frac{2}{11} \times \frac{3}{2\frac{1}{4}} = 14\frac{18}{11}$; $97\frac{1}{4} = \frac{399}{4}$; $14\frac{18}{11} \times \frac{399}{4} = \frac{5711620}{44} = 3924\frac{68}{88}$ miles, Ans.
74. $97\frac{3}{4} = 98\frac{1}{4}$; $\frac{500}{98\frac{1}{4}} \times \frac{1}{98\frac{1}{4}} = \frac{5000}{9601}$; $32\frac{7}{12} = 32\frac{1}{12}$; $\frac{5000}{9601} \times \frac{32\frac{1}{12}}{98\frac{1}{4}} = \frac{2000}{12} = 166\frac{2}{3}$ miles, Ans.
75. $19\frac{5}{8} = 19\frac{1}{8}$; $87\frac{3}{4} = 87\frac{1}{4}$; $19\frac{1}{8} \times \frac{87\frac{1}{4}}{87\frac{3}{4}} = 19\frac{1}{2} = 19\frac{1}{2}$; $\frac{34}{153} \times \frac{60}{1} \times \frac{1}{2} = \frac{14280}{153} = 93\frac{1}{3}$ bu. Ans.

NOTE. The pupil will find, in performing the above questions, that he can abridge the operation by *cancellation*.

MISCELLANEOUS QUESTIONS.

1. (p. 133.) $17\frac{3}{4} = \frac{180}{4}$; $4\frac{1}{2} = \frac{43}{4}$; $\frac{180}{4} \times \frac{43}{4} = \frac{1470}{16} = 82\frac{14}{16}$ miles, ≈ 82 m. 4fur. 8rd. 1ft. 4in. Ans.
2. $29\frac{7}{13} = \frac{384}{13}$; $\frac{384}{13} \times \frac{384}{13} = \frac{147456}{169} = 872\frac{88}{169}$ poles, $= 5$ A. 1R. 32 $\frac{88}{169}$ p. $\frac{88}{169}$ p. $= 141$ ft. 109 $\frac{14}{169}$ in. Ans.
3. $17\frac{3}{4} = \frac{71}{4}$; $7\frac{1}{4} = \frac{29}{4}$; $4\frac{1}{2} = \frac{23}{4}$; $\frac{71}{4} \times \frac{29}{4} \times \frac{23}{4} = \frac{127874}{64} = 578\frac{19}{64}$ feet; $578\frac{19}{64} \div 128 = 4$ cords $66\frac{19}{64}$ cubic feet, Ans.
4. $19\frac{7}{8} = \frac{155}{8}$; $6\frac{3}{4} = \frac{27}{4}$; $\frac{155}{8} \times \frac{27}{4} = \frac{4285}{32} = \$ 134.15\frac{5}{8}$ Ans.
5. $376\frac{1}{4} = \frac{1477}{4}$; $75\frac{3}{8} = \frac{603}{8}$; $\frac{1477}{4} \times \frac{603}{8} = \frac{887777}{32} = \$ 28387.06\frac{1}{4}$ Ans.
6. $17\frac{11}{12} = \frac{1823}{12}$; $4.75 = \frac{475}{100} = \frac{19}{4}$; $\frac{1823}{12} \times \frac{19}{4} = \frac{345425}{48} = \$ 81.55\frac{5}{48}$ Ans.
7. $1670\frac{7}{13} = \frac{21717}{13}$; $12\frac{3}{4} = \frac{51}{4}$; $\frac{21717}{13} \times \frac{51}{4} = \frac{1107587}{52} = \$ 212.99\frac{7}{52}$ Ans.
8. $28\frac{1}{4} = \frac{113}{4}$; $11\frac{3}{4} = \frac{47}{4}$; $\frac{113}{4} \times \frac{47}{4} = \frac{5281}{16} = \$ 333.27\frac{1}{16}$ Ans.
9. $37\frac{1}{2} = \frac{231}{2}$; $17.62\frac{1}{2} = \frac{3525}{2}$; $\frac{231}{2} \times \frac{3525}{2} = \frac{82455}{4} = \$ 655.20\frac{5}{4}$ Ans.
10. $\frac{1}{2} \times \frac{57}{5} = \frac{102}{5} = \$ 5.03\frac{1}{5}$ Ans.
11. $139\frac{1}{4} = \frac{557}{4}$; $38\frac{1}{4} = \frac{153}{4}$; $\frac{557}{4} \times \frac{153}{4} = \frac{84851}{16} = 5415\frac{13}{16}$ poles $= 33$ A. 3R. 15 $\frac{13}{16}$ p. Ans.
12. $11\frac{3}{5} = \frac{58}{5}$; $\frac{58}{5} \times \frac{15}{5} = \frac{870}{25}$; $\frac{870}{25} \times \frac{1}{5} = \frac{174}{25} = 19\frac{4}{25}$ feet, Ans.
13. $18\frac{3}{4} = \frac{75}{4}$; $48.15\frac{3}{4} = \frac{19263}{4}$; $\frac{19263}{4} \times \frac{75}{4} = \frac{144105}{16} = \$ 2.62\frac{4}{5}$ Ans.
14. $98\frac{7}{8} = \frac{791}{8}$; $\frac{791}{8} \times \frac{79}{8} = \frac{6241}{64} = \$ 1.56\frac{11}{16}$ Ans.
15. $8\frac{3}{5} = \frac{43}{5}$; $\frac{43}{5} \times \frac{1}{5} = \frac{43}{25} = \$ 1.64\frac{3}{25}$ Ans.
16. $11 \times 63 = 693$; $693 + 17\frac{1}{2} = 710\frac{1}{2} = \frac{1421}{4}$; $19\frac{3}{4} = \frac{79}{4}$; $\frac{1421}{4} \times \frac{79}{4} = \frac{112259}{16} = \$ 140.32\frac{3}{4}$ Ans.
17. $63 \times 4 \times 2 = 504$ pts.; $1\frac{1}{2} = \frac{7}{4}$; $\frac{504}{7} \times \frac{7}{4} = \frac{2016}{28} = 288$ bottles, Ans.
18. $18\frac{7}{12} = \frac{223}{12}$; $10\frac{5}{12} = \frac{125}{12}$; $7\frac{1}{2} = \frac{82}{12}$; $\frac{223}{12} \times \frac{125}{12} \times \frac{82}{12} =$

$= \frac{2648.125}{1728} = 1532\frac{828}{1728}$ cubic feet. $1532\frac{828}{1728} \div 128$
 $= 11$ cords $124\frac{828}{1728}$ cubic feet, Ans.

19. $6\frac{1}{4} = \frac{25}{4}$; $6\frac{1}{4} = \frac{25}{4}$; $\frac{25}{4} \times \frac{25}{4} = \frac{625}{16} = \$ 4.52\frac{1}{2}$
 Ans.

20. $8\frac{3}{4} = \frac{35}{4}$; $5\frac{7}{8} = \frac{47}{8}$; $3 = \frac{8}{8}$; $\frac{35}{4} \times \frac{47}{8} \times \frac{8}{8} = \frac{1035}{8} =$
 $146\frac{1}{8}$ feet, Ans.

21. $46\frac{1}{2} = \frac{93}{2}$; $17\frac{1}{2} = \frac{35}{2}$; $\frac{93}{2} \times \frac{35}{2} = \frac{18485}{4} = 812\frac{1}{4}$
 feet, Ans.

22. $2\frac{1}{2} + 3\frac{1}{2} = 5\frac{1}{2}$; $5\frac{1}{2} \times \frac{1}{2} = 11$; $11 \times 5\frac{1}{2} = 60\frac{1}{2}$;
 $2\frac{1}{2} = \frac{5}{2}$; $3\frac{1}{2} = \frac{7}{2}$; $\frac{5}{2} \times \frac{7}{2} \times \frac{1}{2} = \frac{35}{4} = 14\frac{1}{4}$;
 $60\frac{1}{2} + 14\frac{1}{4} = 75\frac{1}{2}$; $75\frac{1}{2} \times \frac{1}{2} = 52\frac{1}{2}$ feet, Ans.
 $5\frac{1}{2} = \frac{11}{2}$; $2\frac{1}{2} = \frac{5}{2}$; $3\frac{1}{2} = \frac{7}{2}$; $\frac{11}{2} \times \frac{5}{2} \times \frac{7}{2} \times \frac{1}{2}$
 $\times \frac{1}{2} = \frac{115725}{32} = 286\frac{25}{32}$ cubic feet, Ans.

23. $12 + 11\frac{1}{2} = 23\frac{1}{2}$; $23\frac{1}{2} \times 2 = 47$; $47 \times 7\frac{1}{2} = 352\frac{1}{2}$;
 $12 \times 11\frac{1}{2} = 138$; $352\frac{1}{2} + 138 = 490\frac{1}{2}$; $490\frac{1}{2} \times .02\frac{1}{2}$
 $= \$ 13.48\frac{1}{2}$ Ans.

24. $14\frac{1}{2} = \frac{29}{2}$; $10\frac{1}{4} = \frac{41}{4}$; $16\frac{1}{2} = \frac{33}{2}$; $\frac{29}{2} \times \frac{33}{2} = \frac{947}{4} =$
 $239\frac{1}{4}$; $\frac{41}{4} \times \frac{33}{2} = \frac{1368}{8} = 169\frac{1}{2}$; $239\frac{1}{4} + 169\frac{1}{2} =$
 $408\frac{3}{4}$; $408\frac{3}{4} \times 2 = 816\frac{1}{2}$; $816\frac{1}{2} + 12 = 828\frac{1}{4}$; $828\frac{1}{4}$
 $\times 3 \times 4\frac{1}{4} \times 2 = \$ 223.76\frac{1}{4}$ Ans.

25. $14\frac{1}{2} = \frac{17}{2}$; $5\frac{1}{2} = \frac{11}{2}$; $4\frac{1}{4} = \frac{17}{4}$; $2150\frac{1}{2} = \frac{10750}{2}$;
 $\frac{17}{2} \times \frac{11}{2} \times \frac{17}{4} \times \frac{17}{1} \times \frac{1}{10750} = \frac{1824584000}{6193152} =$
 $294\frac{1}{2}$ bushels, Ans.

26. $10 \times 8 \times 6 = 480$; $8 \times 8 \times 8 = 512$; $512 - 480 =$
 32 feet, Ans.

27. $1112\frac{1}{8} = \frac{8901}{8}$; $\frac{8901}{8} \times \frac{1}{125} = \frac{8901}{1000} = \$ 8\frac{1}{8}$ Ans.

28. $7\frac{1}{2} = \frac{15}{2}$; $\frac{15}{2} \times \frac{8}{1} = \frac{120}{2} = \$ 538\frac{1}{2}$ Ans.

29. $8\frac{3}{4} = \frac{35}{4}$; $42\frac{3}{4} = \frac{171}{4}$; $\frac{35}{4} \times \frac{171}{4} = \frac{5985}{16} = \$ 369.20$
 Ans.

30. $\frac{8}{3} - \frac{2}{3} = 0$.

31. $20 \times 15 = 300$ ft., contents of upper part of the room.

$20 + 15 = 35$; $35 \times 2 = 70$ ft., length round the room.

$70 \times 8\frac{1}{2} = 595$ ft., contents of upright ceiling of the room.

$2 \times 7 \times 3 = 42$ ft., contents of the doors.

$4 \times 5\frac{1}{2} \times 3\frac{1}{2} = 73\frac{1}{2}$ ft., contents of the windows.

$70 - 6 = 64$; $64 \times \frac{3}{4} = 48\frac{1}{2}$ ft., contents of mopboards.

NOTE. We deduct 6 feet for the two doors.

$$595 + 300 = 895; 42 + 73\frac{1}{2} + 42\frac{1}{2} = 158.$$

$$895 - 158 = 737 \text{ feet}; 737 \div 9 = 81\frac{8}{9} \text{ square yards}.$$

$$81\frac{8}{9} \times 6\frac{1}{4} = \frac{737}{9} \times \frac{25}{4} = \frac{18425}{36} = \$5.11\frac{11}{36} \text{ for plastering}.$$

$$595 - 158 = 437 \text{ ft.}; 437 \div 9 = 48\frac{1}{2} \text{ square yards}.$$

$$48\frac{1}{2} \times .09 = \$4.37 \text{ for papering}.$$

$$48\frac{1}{2} \times 3 = 145\frac{1}{2} = 4\frac{3}{2}; 2\frac{3}{2} = 1\frac{1}{2}; 4\frac{3}{2} \div 1\frac{1}{2} = 4\frac{3}{2} \times \frac{1}{\frac{1}{2}} = 2\frac{1}{2} = \$2.80\frac{1}{2} \text{ for paper.}$$

SECTION XXII.

NUMERATION OF DECIMAL FRACTIONS.

1. (p. 136.)	325.7
2.	465.14
3.	98.07
4.	24.000009
5.	221.00009
6.	49000.049
7.	79002000.105
8.	69015.00015
9.	80000.0083
10.	9000019019.19
11.	27.927
12.	49000000000000.000000000001
13.	21.0001
14.	87000.000087
15.	99099.000009009
16.	17.0117
17.	33.33
18.	47000.0000029
19.	15.04007
20.	11000.11
21.	17.000000000000081
22.	9.000000000057
23.	69000.349

SECTION XXIII.
ADDITION OF DECIMALS.

$$\begin{array}{r} 2. \text{ (p. 138.) } 7564.0052656 \\ 3. \quad \quad \quad 2071.449495 \end{array} \quad | \quad \begin{array}{r} 4. \quad \quad \quad 7234.0968 \\ 5. \quad \quad \quad 6913.5477 \end{array}$$

$$\begin{array}{r} 73.29 \\ 87.047 \\ 3005.0106 \\ 28.03 \\ \hline 29000.005 \end{array} \quad | \quad \begin{array}{r} 209000.000046 \\ 98207.0015 \\ 15.08 \\ .0049 \\ \hline \text{Ans. } 307222.086446 \end{array}$$

Ans. 32193.3826

$$\begin{array}{r} 23000010. \\ 1000.00005 \\ 27.000019 \\ \hline 7.5 \end{array} \quad | \quad \begin{array}{r} 59.059 \\ 25000.0025 \\ 5.000005 \\ 205.05 \\ \hline \text{Ans. } 25269.111505 \end{array}$$

Ans. 23001044.500069

$$\begin{array}{r} 25.000007 \\ 145.643 \\ 175.89 \\ 17.00348 \\ \hline \text{Ans. } 363.536487 \end{array}$$

SECTION XXIV.
SUBTRACTION OF DECIMALS.

$$5. \text{ (p. 139.) } 19.7233 \quad | \quad 6. \quad 9.49989 \quad | \quad 7. \quad 88.9429 \quad | \quad 8. \quad .001$$

$$\begin{array}{r} 9. \\ 97.7 \\ 27.028 \\ \hline \text{Ans. } 70.672 \end{array} \quad | \quad \begin{array}{r} 10. \\ 315.0027 \\ 115.07 \\ \hline \text{Ans. } 199.9327 \end{array}$$

$$\begin{array}{r} 11. \\ 29004005. \\ 29000. \\ 349200.00024 \\ \hline 378200.00024 \end{array} \quad | \quad \begin{array}{r} 12. \\ 1000000. \\ .000001 \\ \hline \text{Ans. } 999999.999999 \end{array}$$

Ans. 23625804.99976

SECTION XXV.

MULTIPLICATION OF DECIMALS.

13. (p. 140.)	.438496	23.	.000019737
14.	.0949416	24.	.225.
15.	.03721061	25.	\$ 153.52,5
16.	26137.65	26.	\$ 18.43,75
17.	152.2756	27.	\$ 46.95
18.	13910.073	28.	\$ 149.51,25
19.	.000000081	29.	\$ 3616.17,5
20.	2401.	30.	\$ 138.37,5
21.	33.5175	31.	\$ 109.66,5
22.	41448651.06	32.	\$ 49.53

SECTION XXVI.

DIVISION OF DECIMALS.

9. (p. 141.)	321.2	19.	3124.3
10.	.758	20.	.31243
11.	.561	21.	312430000.
12.	13.861+	22.	.000031243
13.	749.084	23.	312.43
14.	32000.	24.	31243000000.
15.	.000032	25.	.31243
16.	.5403+	26.	.31243
17.	.0623		

SECTION XXVII.

REDUCTION OF DECIMALS.

CASE II.

20	9.00	28	14.0
	2		3
	45 Ans.	4	3.5
		20	15.875
16	12.00		.79375 Ans.
16	8.750000		
28	21.54687500	4	3.00
4	2.7695312500	4	1.7500
	.6923828125 Ans.		.4375 Ans.

$$\begin{array}{r}
 6. \\
 12 | 9.00 \\
 3 | 2.75000000 \\
 54 | 2.91666666 \\
 40 | 35.53030303 \\
 8 | 5.88825757 \\
 \hline
 .73603219 + \text{Ans.}
 \end{array}$$

$$\begin{array}{r}
 8. \\
 2 | 1.0 \\
 8 | 0.50 \\
 4 | 0.062500 \\
 \hline
 .015625 \text{ Ans.}
 \end{array}
 \quad
 \begin{array}{r}
 9. \\
 40 | 16.0 \\
 4 | 2.4 \\
 \hline
 .6 \text{ Ans.}
 \end{array}$$

CASE III.

2. (p. 144.)

$$\begin{array}{r}
 13 \text{s. } 6\frac{1}{2} \text{d.} \\
 .6 \\
 .05 \\
 .028 \\
 \hline
 .678 \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 19 \text{s. } 8\frac{1}{2} \text{d.} \\
 .950 \\
 .34 \\
 \hline
 .984 \text{ Ans.}
 \end{array}$$

4.

$$\begin{array}{r}
 19 \text{s. } 11\frac{1}{2} \text{d.} = .950 \\
 49 \\
 \hline
 .999
 \end{array}$$

$$\begin{array}{r}
 18 \text{s. } 8\frac{1}{2} \text{d.} = .900 \\
 35 \\
 \hline
 .935
 \end{array}$$

$$\begin{array}{r}
 16 \text{s. } 9\frac{1}{2} \text{d.} = .800 \\
 39 \\
 \hline
 .839
 \end{array}$$

$$\begin{array}{r}
 19 \text{s. } 11\frac{1}{2} \text{d.} = .950 \\
 49 \\
 \hline
 .999
 \end{array}$$

$$\begin{array}{r}
 1 \text{s. } 11 \text{d.} = .050 \\
 46 \\
 \hline
 .096
 \end{array}$$

$$\begin{array}{r}
 13 \text{s. } 3\frac{1}{2} \text{d.} = .650 \\
 14 \\
 \hline
 .664
 \end{array}$$

$$\begin{array}{r}
 3 \text{s. } 0\frac{1}{2} \text{d.} = .150 \\
 3 \\
 \hline
 .153
 \end{array}$$

$$\begin{array}{r}
 16 \text{s. } 0\frac{1}{2} \text{d.} = .800 \\
 1 \\
 \hline
 .801
 \end{array}$$

$$\begin{array}{r}
 17 \text{s. } 5\frac{1}{2} \text{d.} = .850 \\
 23 \\
 \hline
 .873
 \end{array}$$

$$\begin{array}{r}
 17 \text{s. } 7\frac{1}{2} \text{d.} = .850 \\
 32 \\
 \hline
 .882
 \end{array}$$

$$\begin{array}{r}
 13 \text{s. } 4\frac{1}{2} \text{d.} = .650 \\
 19 \\
 \hline
 .669
 \end{array}$$

$$\begin{array}{r}
 \mathcal{L} 7.910 \text{ Ans.}
 \end{array}$$

CASE IV.

2. (p. 145.) $.625 \times 12 = 7.5$ d.; $.5 \times 4 = 2$ qr; $7\frac{1}{2}$ Ans.
 3. $.6725 \times 4 = 2.69$; $.69 \times 28 = 19.32$; $.32 \times 16 = 5.12$; $.12 = \frac{3}{25}$; 2qr. 19lb. $5\frac{3}{25}$ oz. Ans.
 4. $.9375 \times 4 = 3.75$; $.75 \times 4 = 3$; 3qr. 3na. Ans.
 5. $.7895 \times 8 = 6.316$; $.316 \times 40 = 12.64$; $.64 \times 16\frac{1}{4} = 10.56$; $.56 \times 12 = 6.72$; $.72 = \frac{18}{25}$; 6fur. 12rd. 10ft. $6\frac{18}{25}$ in. Ans.
 6. $.9378 \times 4 = 3.7512$; $.7512 \times 40 = 30.048$; $.048 \times 272\frac{1}{4} = 13.068$; $.068 \times 144 = 9.792$; $.792 = \frac{198}{25}$; 3R. 30p. 13ft. $9\frac{18}{25}$ in. Ans.
 7. $.5615 \times 63 = 35.3745$; $.3745 \times 4 = 1.498$; $.498 \times 2 = .996$; $.996 \times 4 = 3.984$; $.984 = \frac{113}{125}$; 35gal. 1qt. 0pt. $3\frac{113}{125}$ gi. Ans.
 8. $.367 \times 365\frac{1}{4} = 134.046\frac{1}{4}$; $.046\frac{1}{4} \times 24 = 1.122$; $.122 \times 60 = 7.32$; $.32 \times 60 = 19.2$; $.2 = \frac{1}{5}$; 134da. 1h. 7m. $19\frac{1}{5}$ sec. Ans.
 9. $.6923828125 \times 4 = 2.76953125$; $.76953125 \times 28 = 21.546875$; $.546875 \times 16 = 8.75$; $.75 \times 16 = 12$; 2qr. 21lb. 8oz. 12dr. Ans.
 10. $.015625 \times 4 = .0625$; $.0625 \times 8 = .5$; $.5 \times 2 = 1$; 1 pint, Ans.
 11. $.55 \times 5 = 2.75$; $.75 \times 4 = 3$; 2qr. 3na. Ans.
 12. $.6 \times 4 = 2.4$; $.4 \times 40 = 16$; 2R. 16p. Ans.
-

SECTION XXVIII.

MISCELLANEOUS EXAMPLES.

1. (p. 148.)

$$\begin{array}{r}
 28 | 18.00 \\
 4 \quad\quad\quad 2.64 \\
 \hline
 7.66 \\
 1.175 \\
 \hline
 3830 \\
 5362 \\
 766 \\
 \hline
 766 \quad 83\frac{1}{4} \\
 9.00 \quad 1,3,3\frac{1}{4} = \\
 \hline
 \$9.00 \quad 1,3\frac{1}{4} \text{ Ans.}
 \end{array}$$

2.

$$\begin{array}{r}
 28 | 14.0 \\
 4 \quad\quad\quad 3.500 \\
 \hline
 19.875 \\
 9.25 \\
 \hline
 99375 \\
 39750 \\
 178875 \\
 \hline
 183.84,3,75 = \\
 \$183.84,3\frac{1}{4} \text{ Ans.}
 \end{array}$$

3.

$$\begin{array}{r}
 40 | 15.000 \\
 4 \quad\quad\quad 2.37500 \\
 \hline
 39.59375 \\
 87.375 \\
 \hline
 19796875 \\
 27715625 \\
 11878125 \\
 27715625 \\
 31675000 \\
 \hline
 3459.50,3,90625 = \\
 \$3459.50,3\frac{1}{4} \text{ Ans.}
 \end{array}
 \quad
 \begin{array}{r}
 40 | 15.000 \\
 8 \quad\quad\quad 3.375000 \\
 \hline
 87.421875 \\
 578.75 \\
 \hline
 437109375 \\
 611953125 \\
 699375000 \\
 611953125 \\
 437109375 \\
 \hline
 50595.41,0,15625 = \\
 \$50595.41\frac{1}{4} \text{ Ans.}
 \end{array}$$

5.

$$\begin{array}{r}
 12 | 9.00 \quad 12 | 3.50 \\
 18.75 \quad 2.29\frac{1}{4} \\
 \hline
 2.29\frac{1}{4} \\
 \hline
 16875 \\
 3750 \\
 3750 \\
 3125 \\
 \hline
 42.96875 \\
 .053 \\
 \hline
 12890625 \\
 21484375 \\
 \hline
 2.27734375 = \$227,7\frac{1}{4} \text{ Ans.}
 \end{array}
 \quad
 \begin{array}{r}
 12 | 7.168 \\
 1.597\frac{1}{4} \\
 \hline
 6.5 \\
 \hline
 7985 \\
 9582 \\
 21\frac{1}{4} \\
 \hline
 10.3826\frac{1}{4} \\
 12 \\
 \hline
 4.5920 \\
 \hline
 10ft. 4.592in. Ans.
 \end{array}$$

$$\begin{array}{r} 7. \\ \hline 29\frac{1}{2} = 29.5 \end{array}$$

$$\begin{array}{r} 4.316)29.500(6h. 50m. 6+\text{sec.} \\ \hline 25896 \\ \hline 3604 \\ \hline 60 \end{array}$$

$$4.316)216240(50m.$$

$$\begin{array}{r} 21580 \\ \hline 440 \\ \hline 60 \end{array}$$

$$4.316)26400(6+\text{sec.} \\ \hline 25896$$

$$\begin{array}{r} 8. \\ \hline 4 | 2.0 \\ 4 | 1.500 \\ \hline 5.375 \\ \hline 5.625 \\ \hline 26875 \end{array}$$

$$\begin{array}{r} 10750 \\ 32250 \\ \hline 26875 \\ \hline 30.234,375 = \end{array}$$

$$\$ 30.234\frac{3}{4} \text{ Ans.}$$

$$\begin{array}{r} 9. \\ \hline 28 | 7.00 \\ 4 | 3.2500 \\ \hline 4.8125 \\ \hline 5.875 \end{array}$$

$$\begin{array}{r} 240625 \\ 336875 \\ 385000 \\ 240625 \\ \hline 282734375 \end{array}$$

$$\begin{array}{r} 17 \\ \hline 1979140625 \\ 282734375 \\ \hline \end{array}$$

$$480.648,4375 =$$

$$\$ 480.648\frac{7}{16} \text{ Ans.}$$

$$\begin{array}{r} 10. \\ \hline 40 | 25.000 \\ 4 | 3.625 \\ \hline 176.90625 \\ \hline 75.375 \end{array}$$

$$\begin{array}{r} 88453125 \\ 123834375 \\ 53071875 \\ 88453125 \\ \hline 123834375 \\ \hline 13334308,59375 = \\ \$ 13334308\frac{5}{16} \text{ Ans.} \end{array}$$

$$\begin{array}{r} 11. \\ \hline 17.625 \\ 12.75 \\ \hline 88125 \end{array}$$

$$\begin{array}{r} 123375 \\ 35250 \\ 17625 \\ \hline 224.71875 = \end{array}$$

$$\$ 224.718\frac{3}{4} \text{ Ans.}$$

$$\begin{array}{r} 12. \\ \hline 19\text{ft. } 3\text{in.} = 19.25 \\ 15\text{ft. } 9\text{in.} = 15.75 \end{array}$$

$$\begin{array}{r} 9625 \\ 13475 \\ 9625 \\ 1925 \\ \hline 303.1875 \\ 144 \\ 7500 \\ 7500 \\ 1875 \\ \hline 270000 \end{array}$$

$$303\text{ft. } 27\text{in. Ans.}$$

$$\begin{array}{r} \text{13.} \\ 14\text{ft. 6in.} = 14.5; 12\text{ft. 6in.} = 12.5; 8\text{ft. 9in.} = 8.75; \\ 14.5 + 12.5 = 27.; 27. \times 2 = 54.; 8.75 \times 54. = 472.5; \\ 472.5 \div 9 = 52\frac{1}{4}\text{yds. Ans.} \end{array}$$

$$\begin{array}{r} \text{14.} \\ 10\text{ft. 7in.} = 127; 5\text{ft. 10in.} = 70; 127 \times 70 \times 4 = \\ 35560; 35560 \div 144 = 246\frac{1}{4}\text{ft. Ans.} \end{array}$$

$$\begin{array}{r} \text{15.} \\ 4 \longdiv{3.00} & 4 \longdiv{2.0} \\ 2.75 & \\ \hline 4.6875 & \end{array}$$

$$\begin{array}{r} 4.6875)1125.000(24 \text{ Ans.} & 1.82 + 1.625 = 1.12; \\ 93750 & 1.12 \times 63 = \$70.56 \text{ Ans.} \\ \hline 187500 & \\ \hline 187500 & \end{array}$$

$$\begin{array}{r} \text{17.} \\ 125\frac{1}{2}\text{yd.} = 125.5 \\ 15.06 \div 125.5 = \$0.12 \text{ Ans.} \end{array}$$

$$\begin{array}{r} \text{16.} \\ 2 \longdiv{1.0} \\ 4 \\ \hline 1.625 \end{array}$$

$$\begin{array}{r} \text{18.} \\ 4 \longdiv{3.00} \\ 17.75 \\ 3.575 \\ \hline 8875 \\ 12425 \\ 8875 \\ 5325 \\ \hline 63456,25 = \\ \$63456,2\frac{1}{2} \text{ Ans.} \end{array}$$

$$\begin{array}{r} \text{19.} \\ 87.25 \times 7\frac{1}{3} = 675.84\frac{8}{3} \\ \$675.84\frac{8}{3} \text{ Ans.} \end{array}$$

$$\begin{array}{r} \text{20.} \\ 34\text{ft. 9in.} = 34.75; 1\text{ft. 3in.} = 1.25; 1\text{ft. 6in.} = 1.5 \\ 34.75 \times 1.25 \times 1.5 = 65.15625\text{ft. Ans.} \end{array}$$

$$\begin{array}{r} \text{21.} \\ 28 \longdiv{7.00} \\ \quad 4 \quad 1.00 \\ \quad 12 \quad 18.25 \\ \quad 25 \quad \\ \quad 75 \quad \\ \quad 50 \quad \\ \quad 25 \quad \\ \quad 25 \quad \\ \quad 00 \quad \end{array} \qquad \begin{array}{r} \text{22.} \\ 4 \longdiv{1.00} \\ \quad 18.25 \\ \quad 16 \quad 00 \\ \quad 22 \quad 25 \\ \quad 20 \quad \\ \quad 25 \quad \\ \quad 25 \quad \\ \quad 00 \quad \end{array}$$

$36.50 + 18.25 = \$2.00$ Ans.

115625
161875 23.
161875 \$ 477.72 + 9 = \$ 53.08 Ans.
23125

$$\begin{array}{r}
 24. \\
 5.375 \\
 1.78 \\
 1.1875 \\
 1.125 \\
 1.275 \\
 2.625 \\
 3.3675 = \\
 3.3674 \text{ Ans.}
 \end{array}
 \qquad
 \begin{array}{r}
 25. \\
 3\frac{1}{4} = 2.375; \quad 3\frac{7}{8} = 3.875; \quad 1\frac{1}{8} = 1.0625 \\
 2.375 + 3.875 + 1.0625 = 7.3125 \\
 \hline
 17.625 \\
 365625 \\
 146250 \\
 438750 \\
 511875 \\
 73125
 \end{array}$$

28	7.00	40	35.000
4	2.2500	4	3.87500
	<u>3.5625</u>		<u>37.96875</u>
	13.625		125.75
178125		18984375	
71250		26578125	
213750		18984375	
106875		7593750	
35625		3796875	
<u>48.5390625</u>	=	<u>47745703125</u>	=
\$ 485,39 ₁₅	Ans.	\$ 4774570 ₁₅	Ans.

$$\begin{array}{r}
 \text{28.} \\
 28 | 21.00 \\
 \underline{4} \quad \underline{2.7500} \\
 17.6875 \\
 \underline{11.25} \\
 \underline{\underline{884375}} \\
 353750 \\
 176875 \\
 176875 \\
 \hline
 198.98,4375 = \\
 \$198.98,4\frac{5}{8} \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 \text{29.} \\
 9.375 \\
 \underline{3.37} \\
 \underline{\underline{65625}} \\
 28125 \\
 \underline{28125} \\
 \underline{\underline{3159375}} \\
 7.75 \\
 \hline
 15796875 \\
 22115625 \\
 \underline{22115625} \\
 \underline{\underline{2448515625}} \\
 \$244.85,1\frac{5}{16} \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 \text{30.} \\
 97.625 \\
 \underline{74\frac{5}{8}} \\
 \underline{\underline{683375}} \\
 75930\frac{5}{8} \\
 759.30,5\frac{5}{8} = \\
 \$759.30,5\frac{5}{8} \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 \text{31.} \\
 4 | 3.00 \\
 4 | 3.7500 \\
 \underline{\underline{7.9375}} \\
 4.75 \\
 \hline
 396875 \\
 555625 \\
 \underline{317500} \\
 \underline{\underline{37.70,3125}} \\
 \$37.70,3\frac{1}{8} \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 \text{32.} \\
 28 | 3.500 \\
 \underline{4} \quad \underline{1.12500} \\
 \underline{20} \quad \underline{\underline{15.28125}} \\
 \underline{27.7640625} \\
 183.62 \\
 \underline{\underline{555281250}} \\
 1665843750 \\
 832921875 \\
 2221125000 \\
 277640625 \\
 \hline
 5098.037,156250 = \\
 \$5098.037,7\frac{5}{32} \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 \text{33.} \\
 40 | 15.000 \\
 8 | 3.375000 \\
 \underline{\underline{17.421875}} \\
 1725.875 \\
 \underline{\underline{87109375}} \\
 121953125 \\
 139375000 \\
 87109375 \\
 34843750 \\
 121953125 \\
 17421875 \\
 \hline
 30067.978,515625 = \\
 \$30067.978\frac{5}{64} \text{ Ans.}
 \end{array}$$

$$\begin{array}{r} 34. \\ 40 \Big| 15. \\ 4 \quad\quad 3.375 \\ \hline A. 17.84375 \end{array}$$

$$\$ 624.53125 \div 17.84375 = \\ \$ 35 \text{ Ans.}$$

$$\begin{array}{r} 35. \\ 28 \Big| 14. \\ 4 \quad\quad 2.5 \\ \hline 20 \quad\quad 15.625 \\ \hline T. 19.78125 \end{array}$$

$$\$ 494.53125 \div 19.78125 = \\ \$ 25 \text{ Ans.}$$

$$36. \\ 40) \$ 1004.75$$

$$\begin{array}{r} A. 25.11875 \\ 4 \\ \hline R. .47500 \\ 40 \end{array}$$

$$\begin{array}{r} p. 19.00000 \\ Ans. 25A. OR. 19p. \end{array}$$

$$37. \\ 9) 157.753125 \mathcal{L} \\ \mathcal{L} 17.528125 \\ 20$$

$$\begin{array}{r} s. 10.562500 \\ 12 \\ \hline d. 6.750000 \end{array}$$

$$38. \\ 28 \Big| 21. \\ 4 \quad\quad 2.75 \\ \hline \text{cwt. } 17.6875$$

$$\begin{array}{r} 4 \\ \hline \text{qr. } 3.000000 \\ \hline \text{Ans. } 17\mathcal{L}. 10s. 6\frac{3}{4}d. \end{array}$$

$$\$ 198.984375 \div 17.6875 = \\ \$ 11.25 \text{ Ans.}$$

SECTION XXIX.

EXCHANGE OF CURRENCIES.

$$3. (\text{p. } 150.) \\ 12 \Big| 6. \\ 20 \Big| 7.5 \\ \hline \mathcal{L} 78.375$$

$$\begin{array}{r} 4. \\ \$ 261.25 \times \frac{4}{5} = \mathcal{L} 78.375 \\ .375 \times 20 = s. 7.5 \\ .5 \times 12 = d. 6. \end{array}$$

$$78.375 \mathcal{L} \div \frac{3}{5} = \$ 261.25, \text{ Ans.}$$

$$78 \mathcal{L}. 7s. 6d. \text{ Ans.}$$

$$12 \Big| 6. \\ 20 \Big| 16.5 \\ \hline \mathcal{L} 46.825$$

$$\begin{array}{r} 6. \\ \$ 117.06 \frac{1}{4} \times \frac{4}{5} = \mathcal{L} 46.825 \\ .825 \times 20 = s. 16.5 \\ .5 \times 12 = d. 6.0 \end{array}$$

$$46.825 \mathcal{L} \div \frac{4}{5} = \$ 117.06 \frac{1}{4}$$

$$46 \mathcal{L}. 16s. 6d. \text{ Ans.}$$

$$387\text{£.} \div \frac{3}{7} = \$1032 \text{ Ans.} \quad \$1032 \times \frac{3}{7} = 387\text{£.} \text{ Ans.}$$

$$\begin{array}{rcl} 12\text{£. } 12\text{s.} & = & 12.6\text{£.} \\ 12.6\text{£.} \div \frac{7}{5} & = & \$54 \text{ Ans.} \end{array} \quad \begin{array}{rcl} \$54 \times \frac{7}{5} & = & £12.6 \\ .6 \times 20 & = & \text{s. } 12. \\ 12\text{£. } 12\text{s.} & & \text{Ans.} \end{array}$$

$$\begin{array}{rcl} 12 | \begin{array}{r} 6 \\ 18.5 \end{array} & & \$515.70 \times \frac{1}{12} = £128.925 \\ \cancel{12} & & .925 \times 20 = \text{s. } 18.5 \\ & & .5 \times 12 = \text{d. } 6.0 \\ 128.925\text{£.} \div \frac{1}{12} & = & \$515.70 \text{ Ans.} \end{array} \quad \begin{array}{rcl} \$515.70 & & 128\text{£. } 18\text{s. } 6\text{d.} \text{ Ans.} \\ .925 \times 20 & = & \text{s. } 18.5 \\ .5 \times 12 & = & \text{d. } 6.0 \end{array}$$

SECTION XXX.

CIRCULATING DECIMALS.

CASE I.

2. (p. 153.) $.3 = \frac{3}{10} = \frac{3}{5}$ Ans.
 3. $1.62 = 1.62\dot{1} = 1.\underline{621} = 1\frac{62}{99}$ Ans.
 4. $.769230\dot{0} = 769230\dot{0} = 1\frac{2}{9}$ Ans.

CASE II.

2. (p. 154.) $.53 = \frac{53}{100} = \frac{53}{50} = \frac{53}{10}$ Ans.
 3. $.5925 = \frac{5925}{10000} = \frac{5925}{5000} = \frac{5925}{1000} = 1\frac{925}{999}$ Ans.
 4. $.008497133 = \frac{8497133}{1000000} = \frac{8497133}{1000000} = 8497133\dot{0}$ Ans.
 5. $31.62 = 31.62\dot{1} = 31.\underline{621} = 31\frac{62}{99}$ Ans.

CASE III.

2. (p. 155.) $3.\dot{6}7\dot{1} = 3.671671671\dot{6}7\dot{1}$; $1.\dot{0}07\dot{1} = 1.00710071007\dot{1}$; $8.\dot{5}2 = 8.525252525252\dot{2}$; $7.\dot{6}16325616325\dot{6} = 7.616325616325\dot{6}$ Ans.
 3. $1.\dot{5}2 = 1.52\dot{5}252\dot{5}$; $8.\dot{7}15\dot{6} = 8.715671\dot{5}\dot{6}$; $3.\dot{5}6\dot{7} = 3.567777\dot{7}$; $1.\dot{3}7\dot{8} = 1.378787\dot{8}$ Ans.
 4. $.000\dot{7} = .00070707\dot{0}$; $.141\dot{4}14 = .141414414\dot{1}$; $887.\dot{1} = 887.111111111\dot{1}$ Ans.

CASE IV.

3. (p. 156.) As the denominator 11 cannot be divided by 2, 5, or 10, the decimal is infinite. Then, $\frac{1}{11} = 0.\overline{09}$. As two 9's are used, the circulate will consist of two places; thus,

$$\frac{1}{11} = 0.\overline{09}$$
 Ans.

4. $\frac{253}{9999999999999999999999}$. As twenty-two 9's are necessary to complete the division without a remainder, so we infer that the repetend will consist of twenty-two places; thus, $\frac{1}{253} = .4229249011857707509881$ Ans.

SECTION XXXI.

ADDITION OF CIRCULATING DECIMALS.

2. (p. 157.)	3.
$27.5\dot{6} = 27.5675675675675$	$2.76\dot{5} = 2.76565$
$5.\dot{6}3\dot{2} = 5.6326326326326$	$7.1\dot{6}67\dot{4} = 7.16674$
$6.\dot{7} = 6.77777777777777$	$3.6\dot{7}1\dot{3}6 = 3.67136$
$16.3\dot{5}\dot{6} = 16.3565656565656$	$.7 = .77777$
$.7\dot{1} = .7111111111111$	$.1\dot{7}28 = .1728$
$6\,\dot{1}23\dot{4} = \underline{6.1234123412341}$	
<u>Ans. 14.55436</u>	

$$\begin{array}{rcl} & \text{5.} & \\ \frac{1}{3} & = .\dot{3} & = .\overline{333333} \\ \frac{1}{7} & = .\overline{142857} & = .\overline{142857} \\ \frac{1}{6} & = .\overline{1} & = \underline{\overline{111111}} \\ \\ \text{Ans. } & \underline{.587301} & \end{array}$$

SECTION XXXII.

SUBTRACTION OF CIRCULATING DECIMALS.

2. (p. 158.)

$$\begin{array}{r} 7.1 \\ - 5.02 \\ \hline \text{Ans. } 2.0\dot{8} \end{array}$$

3.

$$\begin{array}{r} 315.8\dot{7} \\ - 78.0\dot{3}7\dot{8} \\ \hline \text{Ans. } 237.83807209549\dot{7} \end{array}$$

4.

$$\begin{array}{r} \frac{1}{3} = .\dot{3} \\ + .142857 \\ \hline \text{Ans. } \underline{.079365} \end{array}$$

5.

$$\begin{array}{r} 16.134\dot{7} \\ - 11.089\dot{4} \\ \hline \text{Ans. } \underline{5.046\dot{2}} \end{array}$$

6.

$$\begin{array}{r} 18.167\dot{8} \\ - 3.\dot{2}\dot{7} \\ \hline \text{Ans. } \underline{14.895\dot{1}} \end{array}$$

7.

$$\begin{array}{r} 3.\dot{1}\dot{2}\dot{3} \\ - .7\dot{1} \\ \hline \text{Ans. } \underline{2.40595\dot{1}} \end{array}$$

8.

$$\begin{array}{r} \frac{1}{7} = .\dot{4}2857\dot{1} \\ - .\dot{1}\dot{8} \\ \hline \text{Ans. } \underline{.246753} \end{array}$$

9.

$$\begin{array}{r} \frac{4}{7} = .\dot{4}44444 \\ - .\dot{2}8571\dot{4} \\ \hline \text{Ans. } \underline{.15873\dot{0}} \end{array}$$

10.

$$\begin{array}{r} \frac{8}{7} = .\dot{5}29411764705882\dot{3} \\ - .\dot{3}529411764705882 \\ \hline \text{Ans. } \underline{.176470588235294\dot{1}} \end{array}$$

11.

$$\begin{array}{r} 5.1\dot{2}34\dot{5} = 5.12345123451234512345123451 \\ 2.3\dot{5}234\dot{5}6 = 2.3523456523456523456523456523456 \\ \hline \end{array}$$

$$\text{Ans. } 2.7711055921666927777988888599994$$

SECTION XXXIII.

MULTIPLICATION OF CIRCULATING DECIMALS.

(p. 159.)

3.

87.32586

437

$$\begin{array}{r} 61128106 \\ 26197759 \\ 34930346\dot{4} \\ \hline \end{array}$$

$$\text{Ans. } 381.614033\dot{6}$$

$$\begin{array}{r} 4. \quad 3.1\dot{4}\dot{5} = 3.1\dot{4}\dot{5} = 3.1\dot{4} = \dot{4}\dot{4}\dot{5}; \quad 4.\dot{2}9\dot{7} = 4\dot{2}9\dot{7} = \\ 4\dot{2}9\dot{7} = \frac{149}{37}; \quad \frac{149}{37} \times \frac{149}{37} = \frac{149 \cdot 14}{37 \cdot 37} = 13.5169533 \quad \text{Ans.} \end{array}$$

5.

.285714

28

2285714

5714285

$$\text{Ans. } 8.000000\dot{0}$$

6.

.461607142857

20

9.232142857142

4

0.928571428571

28

742857142857118571428571428

$$\text{Ans. } 26.000000000000\dot{0}$$

$$\begin{array}{r}
 .2\dot{8}493150\dot{6} \\
 -365 \\
 \hline
 1424657534 \\
 -1709589041. \\
 \hline
 85479452054 \\
 \hline
 \text{Ans. } 104.000000000\dot{6}
 \end{array}$$

SECTION XXXIV.

DIVISION OF CIRCULATING DECIMALS.

2. (p. 159.) $345.\dot{8} = 345\frac{8}{9}$; $.8 = \frac{8}{10} = \frac{4}{5}$; $345\frac{8}{9} \div \frac{4}{5} = 518\frac{8}{9} = 518.8\dot{3}$ Ans.
3. $234.\dot{6} = 234\frac{6}{9}$; $.6 = \frac{6}{10} = \frac{3}{5}$; $234\frac{6}{9} \div \frac{3}{5} = 301\frac{1}{5} = 301.7\dot{1}$.
4285 Ans.
4. $.3\dot{6} = \frac{36}{100} = \frac{18}{50} = \frac{9}{25}$; $.2\dot{5} = \frac{25}{100} + \frac{5}{100} = \frac{30}{100} = \frac{3}{10}$; $\frac{9}{25} \div \frac{3}{10} = \frac{9}{25} \times \frac{10}{3} = \frac{108}{75} = 1.4229249011857707509881$ Ans.
-

SECTION XXXV.

MENTAL OPERATIONS IN FRACTIONS.

2. (p. 160.) $56\frac{1}{4}$	13. $80\frac{1}{4}$	24. 6391	
3. $12\frac{1}{4}$	14. $143\frac{3}{4}$	25. 9991	
4. $90\frac{1}{4}$	15. $399\frac{1}{4}$	26. 391	
5. $132\frac{1}{4}$	16. $8099\frac{1}{4}$	27. $\$ 396$	
6. $420\frac{1}{4}$	18. $634\frac{5}{8}$	28. $\$ 891$	
7. $930\frac{1}{4}$	19. $99\frac{3}{4}\frac{1}{4}$	29. $\$ 35.84$	
9. 1225	20. $80\frac{7}{16}$	30. $\$ 886$	
10. 7225	21. $399\frac{1}{16}\frac{1}{16}$	31. $\$ 2499$	
11. 9025	23. 6375		

SECTION XXXVI.

QUESTIONS TO BE PERFORMED BY ANALYSIS.

2. (p. 162.) $6.48 \div 72 = .09$; $675 \times .09 = \$ 60.75$ Ans.
 3. $1 + \frac{1}{8} = 8$; $29\frac{1}{4} \times 8 = 239$ lbs. Ans.
 4. $\$ 73.50 \div 63 = 1.16\frac{2}{3}$; 17hhd. 45gal. = 1116gal.;
 $1116 \times 1.16\frac{2}{3} = \$ 1302.00$ Ans.
 5. $\$ 9.00 \div 11 = \$ 0.81\frac{9}{11}$; $.81\frac{9}{11} \times 25 = \$ 20.45\frac{5}{11}$
 Ans.
 6. $1620 \div 15 = 108$; $108 \times 27 = 2916$ lbs. Ans.
 7. $\$ 7.00 \div 9 = .77\frac{1}{9}$; $.77\frac{1}{9} \times 37\frac{1}{8} = \$ 29.31\frac{1}{4}$ Ans.
 8. $8 \times 9 = 72$; $72 \div 23 = 3\frac{2}{23}$ weeks, Ans.
 9. $7\frac{1}{12} = \frac{85}{12}$; $19\frac{1}{2} = \frac{39}{2}$; $\frac{85}{12} \times \frac{39}{2} = \frac{3282.00}{8}$;
 ~~$\frac{3282.00}{8} \times \frac{23}{12} = \frac{8134.50}{144} = \$ 874.95\frac{4}{9}$~~ Ans.
 10. $\$ 25.00 \times \frac{1}{2240} = \frac{25}{2240} = \frac{1}{896}$; 17T. 13cwt. 0qr.
 19 lbs. = 39555lbs.; $\frac{25}{2240} \times \frac{1}{896} = \frac{25}{2007040} = \$ 441.46+$
 Ans.
 11. $9\frac{1}{4} = \frac{37}{4}$; $\frac{37}{4} \times \frac{25}{1} = \frac{100}{3} = 2\frac{2}{3}$ Ans.
 12. $9\frac{1}{4} = \frac{37}{4}$; $\frac{37}{4} \times \frac{1}{5} = \frac{37}{20}$ Ans.
 13. $7\frac{3}{8} = \frac{59}{8}$; $\frac{25}{1} \times \frac{8}{59} = \frac{200}{59}$; $\frac{200}{59} \times \frac{200}{59} = \frac{19400}{3241}$ =
 ~~$\$ 328.81\frac{1}{11}$~~ Ans.
 14. $\$ 47.25 \div 7 = \$ 6.75$; $\$ 6.75 \times 43 = \$ 290.25$ Ans.
 15. $7\frac{1}{2} = \frac{15}{2}$; $1\frac{1}{2} = \frac{3}{2}$; $\frac{15}{2} \times \frac{3}{2} = \frac{45}{4} = 4\frac{1}{4}$ yds. Ans.
 16. $10 \times 7 = 70$; $70 \div 37 = 1\frac{3}{4}$ days, Ans.
 17. $108 \div 9 = 12$; $12 \times 5 = 60$ calves, Ans.
 18. $11 \div 5 = 2\frac{1}{5}$; $2\frac{1}{5} \times 3 = 6\frac{3}{5}$ yds. Ans.
 19. $18 \div 2 = 9$; $9 \times 7 = 63$ pairs, Ans.
 20. $47 \div 7 = 6\frac{5}{7}$; $6\frac{5}{7} \times 4 = 26\frac{4}{7}$ gals. Ans.
 21. $377 \div 15 = 25\frac{2}{15}$; $25\frac{2}{15} \times 100 = 2513\frac{1}{3}$ miles, Ans.
 22. $30 \times 12 = 360$; $360 \div 47 = 7\frac{14}{47}$ days, Ans.
 23. $\$ 25.75 \div 5 = 5.15$; $5.15 \times 39 = \$ 200.85$ Ans.
 24. 17A. = 2720p.; 98A. 3R. 14p. = 15814p. \times
 ~~$\$ 184.01 \times \frac{1}{2720} \times \frac{15814}{3214} = \frac{125993214}{54720} = \$ 4598.90\frac{87}{100}$~~
 Ans.

25. $97\frac{3}{4} = \frac{391}{4}$; $\frac{275.20}{4} \times \frac{5}{7} = \frac{220.160}{7} = 220\frac{160}{7} \times \frac{1}{7} = \frac{1544.20}{7} = \19.78 . Ans.

26. $97 \div 5 = 19\frac{2}{5}$; $19\frac{2}{5} \times 7 = 135\frac{4}{5}$ feet, Ans.

27. $3\frac{1}{4} = \frac{13}{4} \div 11 = \frac{13}{44} = \frac{1}{4} = 4\frac{8}{9} = 5\frac{2}{9}$ cwt. Ans.

28. $47\frac{3}{4} = \frac{191}{4}$; $3\frac{1}{4} = \frac{13}{4}$; $\frac{191}{4} \times \frac{13}{4} = \frac{2424}{16} = 151\frac{3}{4}$ miles, Ans.

29. $10 \times 7 = 70$; $70 \div 12 = 5\frac{5}{6}$ days, Ans.

30. $\frac{11}{4} \times \frac{42.12}{12} \times \frac{5}{6} = \frac{184.520}{48} = \$29.41\frac{1}{2}$ Ans.

31. $\frac{7}{4} \times \frac{10.27}{12} \times \frac{4}{5} = \frac{287.56}{60} = \71.89 Ans.

32. $18 \times 5 = 90$ days; $90 \div 6 = 15$ days. Ans.

33. $19 \div 25 = \frac{19}{25}$; $\frac{19}{25} \times \frac{71.25}{1} = \frac{1363.75}{25} = 54\frac{3}{25}$ gal.

Ans.

34. $1.00 \times 8 = \$8.00$; $\$8.00 \div 1.25 = 6\frac{2}{5}$ oz. Ans.

35. $126 \div 7 = 18$ barrels, Ans.

36. $4\frac{1}{4} = \frac{17}{4}$; $1\frac{3}{8} = \frac{11}{8}$; $\frac{17}{4} \times \frac{11}{8} = \frac{187}{32} = \frac{56}{32} = \frac{1}{6}\frac{2}{3}$; $\frac{1}{6}\frac{2}{3} \div \frac{7}{8} = \frac{16}{64} \times \frac{8}{7} = \frac{20.4}{44.8} = 6$ yd. 1qr. 3 $\frac{3}{4}$ na. Ans.

37. $4 \times 2 \times 1\frac{1}{2} = 12$; $8 \times 4 \times 3 = 96$; $300 \div 12 = 25$; $96 \times 25 = 2400$ lbs. Ans.

38. $12\frac{1}{4} = \frac{49}{4}$; $160 \div \frac{49}{4} = \frac{160}{4} \times \frac{4}{49} = \frac{160}{49} = 12\frac{8}{49}$ rd. Ans.

39. $25\frac{3}{4} = \frac{101}{4}$; $\frac{101}{4} \times \frac{5280}{12} = \frac{1014880}{48} = \frac{1014880}{24} \div 1142 = \frac{1014880}{24} \times \frac{1}{1142} = \frac{3014880}{27432} = 120$ seconds = 2 minutes, Ans.

40. $\frac{7}{11} \times \frac{11}{14} = \frac{7}{14} = \frac{1}{2}$; $\$46.70 \div \frac{1}{2} = \frac{4670}{2} \times 2 = \93.40 , Ans.

41. $\$97 \div 4 = \frac{97}{4}$; $\frac{97}{4} \times \frac{11}{4} = \frac{1067}{16} = \266.75 Ans.

42. $19 \div 50 = \frac{19}{50}$; $\frac{19}{50} \times \frac{16}{5} = \frac{196}{25} = 29\frac{1}{25}$ lbs. Ans.

43. $17\frac{3}{11} = \frac{180}{11}$; $4\frac{1}{4} = \frac{17}{4}$; $\frac{17}{4} \times \frac{180}{11} = \frac{3060}{44} = \frac{1530}{22} = 69\frac{3}{11}$ Ans.

44. 11s. 3d. = 135d.; 15s. = 180d.; $\frac{135}{180} = \frac{1}{2} = 1\frac{1}{2}$ Ans.

45. $7\frac{1}{4}$ yd. = 29 quarters; $3\frac{1}{4}$ ells = 18 quarters; $18 \div 29 = \frac{18}{29}$ Ans.

SECTION XXXVII.

SIMPLE INTEREST.

CASE I.

3. (p. 165.)	\$ 40.50	12.	\$ 15.76,2
4.	\$ 103.68	13.	\$ 926.34
5.	\$ 2.35,6	14.	\$ 222.25
6.	\$ 161.33	15.	\$ 106.58,7
7.	\$ 209.55	16.	\$ 888.54,6
8.	\$ 476.14,4	17.	\$ 499.98,2
9.	\$ 44.44,2	18.	\$ 52.41,2
10.	\$ 267.75	19.	\$ 3.37,5
11.	\$ 7.24,5	20.	\$ 540.00

CASE II.

2. (p. 166.)	\$ 31.85	9.	\$ 1.08
3.	\$ 116.99	10.	\$ 1.14
4.	\$ 40.10	11.	\$ 11.77
5.	\$ 45.08,6	12.	\$ 5.79
6.	\$ 238.63	13.	\$ 41.79
7.	\$ 4.58	14.	\$ 193.09
8.	\$ 286.31		

CASE III.

2. (p. 168.)	\$ 74.91,5	10.	\$ 0.23,6
3.	\$ 26.34,3	11.	\$ 2.70,1
4.	\$ 0.73,9	12.	\$ 17.43,8
5.	\$ 217.93,2	13.	\$ 0.86,6
6.	\$ 0.58,4	14.	\$ 297.51,8
7.	\$ 1.69,9	15.	\$ 179.10,6
8.	\$ 20.16,6	16.	\$ 2.59,6
9.	\$ 3.22,7	17.	\$ 0.12,0

CASE IV.

			2. (p. 169.)				6.
y.	mo.	d.		y.	mo.	d.	
1833	4	11	\$ 786.75	1832	4	5	\$ 763.5
1831	11	9	.085 $\frac{1}{2}$	1830	7	17	.103
1	5	2	<u>393375</u>	1	8	18	<u>22905</u>
			629400				7635
			<u>26225</u>				
			Ans. \$ 6713,600				Ans. \$ 7.86,405
			3.				7.
y.	mo.	d.		y.	mo.	d.	
1829	9	19	\$ 982.5	1828	11	19	\$ 978.6
1826	6	4	.197 $\frac{1}{2}$	1821	4	17	.455 $\frac{1}{2}$
3	3	15	<u>68775</u>	7	7	2	<u>48930</u>
			88425				48930
			9825				39144
			<u>4912 $\frac{1}{2}$</u>				3262
			Ans. \$ 1940,437 $\frac{1}{2}$				Ans. \$ 4455,892
			4.				8.
y.	mo.	d.		y.	mo.	d.	
1833	6	27	\$ 7689.5	1826	5	18	\$ 1728.75
1822	0	11	.692 $\frac{2}{3}$	1823	10	19	.154 $\frac{1}{2}$
11	6	16	<u>153790</u>	2	6	29	<u>691500</u>
			692055				864375
			461370				172875
			<u>51263 $\frac{1}{2}$</u>				144062 $\frac{1}{2}$
			Ans. \$ 53.26,2603 $\frac{1}{2}$				Ans. \$ 267.66,812 $\frac{1}{2}$
			5.				9.
y.	mo.	d.		y.	mo.	d.	
1830	6	18	\$ 2276.3	1832	1	29	\$ 9999.9
1806	1	19	1.464 $\frac{2}{3}$	1800	0	1	1.929 $\frac{2}{3}$
24	4	29	<u>91052</u>	32	1	28	<u>899991</u>
			136578				199998
			91052				899991
			<u>22763</u>				99999
			18969 $\frac{1}{2}$				66666
			Ans. \$ 33.34,4001 $\frac{1}{2}$				Ans. \$ 192.96,4737

y.	mo.	d.	10.
1822	5	17	\$ 16.76
1811	11	17	.68
			<hr/>
10	6	0	5028
			10056
			<hr/>
			Ans. \$ 10.55,88

y.	mo.	d.	11.
1833	11	15	\$ 35.61
1831	10	11	.1253
			<hr/>
2	1	4	17805
			7122
			3561
			2274
			<hr/>
			Ans. \$ 447,399

y.	mo.	d.	12.
1831	7	17	\$ 786.97
1827	9	19	.2293
			<hr/>
3	9	28	708273
			157394
			157394
			524643
			<hr/>
			\$ 18074,0773
			73
			<hr/>
			126518539
			90870383
			<hr/>
			6) 1355555778
			<hr/>
			Ans. \$ 225.9259633

y.	mo.	d.	13.
1832	6	3	\$ 96.84
1829	10	27	.156
			<hr/>
2	7	6	58104
			48420
			9684
			<hr/>
			\$ 15.10,704
			(Carried up.)

.	(Brought up.)
	\$ 15.10,704
	73
	<hr/>
	10574928
	755352
	<hr/>
6)	11330280
	<hr/>
	Ans. \$ 18.88,380

y.	mo.	d.	14.
1832	11	7	\$ 11.10,5
1832	3	17	.0383
			<hr/>
	7	20	88840
			33315
			37013
			<hr/>
			\$ 42,56913
			7
			<hr/>
			6) 29798413
			<hr/>
			Ans. \$ 0.49,664013

y.	mo.	d.	15.
1819	5	17	\$ 117.21
1806	5	19	.7793
			<hr/>
12	11	28	105489
			82047
			82047
			7814
			<hr/>
			\$ 9138,473
			81
			<hr/>
			73107784
			45692363
			<hr/>
			6) 776770203
			<hr/>
			Ans. \$ 129.46,17013

16.
 y. mo. d. 18.
 1832 0 11 \$17869.75
 1830 1 7 .115 $\frac{1}{2}$

$$\begin{array}{r} 111 \quad 4 \quad 8934875 \\ \quad \quad 1786975 \\ \quad \quad 1786975 \\ \quad \quad 1191316\frac{1}{2} \\ \hline \$2066.93,441\frac{1}{2} \\ \quad \quad \quad 5 \end{array}$$

$$6) 1033467208\frac{1}{2}$$

$$\text{Ans. } \$1722.44,534\frac{1}{2}$$

17.
 y. mo. d. 18.
 1827 5 19 \$7109.1
 1823 6 29 .233 $\frac{1}{2}$
 3 10 20 213273
 213273
 142182
 23697

Interest at 6% } \$16.58,7900
 per cent.* } 2

$$\text{Ans. } \$33.17,5800$$

* The interest will be twice this amount
 at 12 per cent.

18.
 y. mo. d. 19.
 1833 6 11 \$83.47
 1830 10 8 .160 $\frac{1}{2}$
 2 8 3 500820

$$8347$$

$$\underline{4173\frac{1}{2}}$$

$$\$13.39,693\frac{1}{2}$$

$$8\frac{1}{2}$$

$$10717548$$

$$1004770\frac{1}{2}$$

$$6) 11722318\frac{1}{2}$$

$$\text{Ans. } \$19.53,719+$$

19.
 y. mo. d. 20.
 1833 6 17 \$79.25
 1831 11 8 .096 $\frac{1}{2}$

$$\begin{array}{r} 1 \quad 7 \quad 9 \\ \hline 47550 \\ 71325 \\ 3962\frac{1}{2} \end{array}$$

$$\text{Ans. } \$7.64,762\frac{1}{2}$$

20.
 y. mo. d. 21.
 1829 9 12 \$175.07
 1825 0 7 .285 $\frac{1}{2}$

$$\begin{array}{r} 4 \quad 9 \quad 5 \\ \hline 87535 \\ 140056 \\ 35014 \\ 14589\frac{1}{2} \end{array}$$

$$\text{Ans. } \$50.04,084\frac{1}{2}$$

21.
 y. mo. d. 22.
 1833 7 20 \$12.75
 1831 5 16 .130 $\frac{1}{2}$

$$\begin{array}{r} 2 \quad 2 \quad 4 \\ \hline 38250 \\ 1275 \\ 850 \end{array}$$

$$\text{Ans. } \$1.66,600$$

22.
 y. mo. d. 23.
 1834 0 11 \$197.28,5
 1832 11 6 .065 $\frac{1}{2}$

$$\begin{array}{r} 1 \quad 1 \quad 5 \\ \hline 986425 \\ 1183710 \\ 164404\frac{1}{2} \end{array}$$

$$\text{Ans. } \$12.98,7929\frac{1}{2}$$

23.			
y.	mo.	d.	
1834	7	30	\$ 12.69
1833	0	2	.099 $\frac{1}{2}$
	1	7	28
			<u>11421</u>
			11421
			846
			<u>\$ 126,477</u>
			7
			<u>6) 885339</u>
			Ans. \$ 147,556 $\frac{1}{2}$

24.			
y.	mo.	d.	
1833	5	10	\$ 79.15
1831	1	11	.139 $\frac{1}{2}$
	2	3	29
			<u>71235</u>
			23745
			7915
			<u>6595 $\frac{1}{2}$</u>
			<u>\$ 1106,780 $\frac{1}{2}$</u>
			7 $\frac{1}{2}$
			<u>7747465 $\frac{1}{2}$</u>
			<u>276695 +</u>
			<u>6) 8024160 +</u>
			Ans. \$ 1337,360

25.			
y.	mo.	d.	
1833	0	1	\$ 83.33
1831	2	11	.108 $\frac{1}{2}$
	1	9	20
			<u>66664</u>
			8333
			<u>2777 $\frac{1}{2}$</u>
			<u>\$ 902,741 $\frac{1}{2}$</u>
			7 $\frac{1}{2}$
			<u>6319187</u>
			451370 $\frac{1}{2}$
			<u>6) 6770557 $\frac{1}{2}$</u>
			1128,426
			8333
			Ans. \$ 946,1426

26.			
y.	mo.	d.	
1831	5	1	\$ 100.25
1831	2	2	.014 $\frac{1}{2}$
	2	29	<u>40100</u>
			10025
			<u>8354 $\frac{1}{2}$</u>
			<u>\$ 148,704 $\frac{1}{2}$</u>
			4
			<u>6) 594816 $\frac{1}{2}$</u>
			.99,136 +
			100.25
			Ans. \$ 101,24,136

27.			
y.	mo.	d.	
1832	6	31	\$ 369.29
1830	3	30	.135 $\frac{1}{2}$
	2	3	<u>184645</u>
			110787
			<u>36929</u>
			<u>6154 $\frac{1}{2}$</u>
			<u>\$ 499,1569 $\frac{1}{2}$</u>
			9
			<u>6) 44924128 $\frac{1}{2}$</u>
			74,87,354
			<u>369.29</u>
			Ans. \$ 444,16,354

28.			
y.	mo.	d.	
1835	5	17	\$ 769.87
1830	0	1	.327 $\frac{1}{2}$
	5	5	<u>538909</u>
			153974
			<u>230961</u>
			<u>51324 $\frac{1}{2}$</u>
			<u>\$ 252,26,073 $\frac{1}{2}$</u>
			9 $\frac{1}{2}$
			<u>227034663</u>
			12613036 +
			<u>6) 239647699 +</u>
			Ans. \$ 399,41,283 +

22.			22.		
1833	5	29	\$ 69.75	1830	6 17
1833	0	11	.028	1824	4 7
5	18		55800	6 2 10	172819
			13950		.371 $\frac{1}{2}$
			195300		1209733
			17 $\frac{1}{2}$		518457
			1367100		115212 $\frac{1}{2}$
			1953	4 × 6 = 24	64231061 $\frac{1}{2}$
			97650		Ans. \$ 26.76,294 +
			6) 3417750		
			Ans. \$ 5.69,625		
30.			33.		
1835	5	19	\$ 368.18	1833	5 30
1816	3	2	1.152 $\frac{1}{2}$	1831	11 29
19	2	17	73636	1 6 1	3574440
			184090		6619 $\frac{1}{2}$
			36818		3581059 $\frac{1}{2}$
			36818		5 $\frac{1}{2}$
			30681 $\frac{1}{2}$		17905296 $\frac{1}{2}$
2 per cent. = $\frac{1}{2}$ of 6; hence	3)	42445,077 $\frac{1}{2}$			1790529
				6)	19695825
					Ans. \$ 32.82,637
			Ans. \$ 14.14 8,359 +		
31.			34.		
1833	11	6	\$ 16.16	1832	11 19
1831	2	3	.165 $\frac{1}{2}$	1831	1 17
2	9	3	8080	1 10 2	1760070
			9696		1760070
			1616		58669
			808		2 × 6 = 12
			6) 2.67,448		19419.439
			Ans. \$ 0.44,574 $\frac{1}{2}$		\$ 16.18,286 +
					1760.0'7
					Ans. \$ 177.6.25,286

35. First find the interest on the shoes from the time they

become due until the time of settlement; add this interest to the value of the shoes.

$$\begin{aligned} \$ 865 \times 1.068\frac{5}{8} &= \$ 924.54; \$ 386.27 \times 1.063\frac{3}{8} = \\ \$ 410.86; \$ 769.25 \times 1.056\frac{3}{8} &= \$ 812.84; \$ 183.75 \\ \times 1.047\frac{1}{8} &= \$ 192.44; \$ 396.81 \times 1.043\frac{1}{8} = 414.00. \\ \$ 924.54 + \$ 410.86 + \$ 812.84 + \$ 192.44 + \$ 414.00 \\ = \$ 2754.68, \text{ amount of the shoes.} \end{aligned}$$

Then find the amount of the sums G. K. M. has received, from the time when received to the time of settlement.

$$\begin{aligned} \$ 1000 \times 1.061\frac{1}{8} &= 1061.33; \$ 375.25 \times 1.053\frac{1}{8} = \\ \$ 395.26; \$ 681.29 \times 1.049 &= \$ 714.67; \$ 100 \times \\ 1.045\frac{1}{8} &= \$ 104.51; \$ 275.28 \times 1.029\frac{1}{8} = \$ 283.40. \\ \$ 1061.33 + \$ 395.26 + \$ 714.67 + \$ 104.51 + \\ \$ 283.40 &= \$ 2559.17, \text{ amount of the sums received.} \\ \$ 2754.68 - \$ 2559.17 &= \$ 195.51 \text{ Ans.} \end{aligned}$$

CASE V.

1. (p. 172.)	$\$ 10.55,7$	$7.$	$\$ 7.96$
2.	$\$ 4.48,5$	$8.$	$\$ 75.30,8$
3.	$\$ 0.18,2$	$9.$	$\$ 0.73$
4.	$\$ 1.99$	$10.$	$\$ 0.85,3$
5.	$\$ 20.66,2$	$11.$	$\$ 2.85$
6.	$\$ 3.28,7$	$12.$	$\$ 1784.81$

SECTION XXXVIII.

PARTIAL PAYMENTS.

Principal,	^{24 (p. 173.)}	$\$ 700.00,0$
Interest from Feb. 4 to Nov. 28, 9mo. 24da.		$\$ 34.30,0$
Amount carried forward,		$\$ 734.30,0$

Amount brought forward,	\$.734.30.0
First payment,	160.00.0
Interest from March 18 to Nov. 28, 8mo.	
10da.	6.66.6
Second payment,	200.00.0
Interest from June 24 to Nov. 28, 5mo.	
4da.	5.13.3
Third payment,	120.00.0
Interest from Sept. 11 to Nov. 28, 2mo.	
17da.	1.54.0
Fourth payment,	60.00.0
Interest from Oct. 5 to Nov. 28, 1mo.	
23da.	.53.0
	<hr/> 553.86.9
Balance remaining due Nov. 28, 1834,	\$.180.43.1

3.

Principal, bearing interest from Aug. 16, 1834,	\$.600.00.0
Interest from Aug. 16, 1834, to Aug. 1, 1835,	
11mo. 15da.	34.50.0
Amount,	<hr/> 634.50.0
First payment, Sept. 18, 1834,	136.00.0
Interest from Sept. 18, 1834, to Aug. 1,	
1835, 10mo. 13da.	7.09.4
Second payment, Dec. 5, 1834,	197.00.0
Interest from Dec. 5, 1834, to Aug. 1,	
1835, 7mo. 26da.	7.74.8
Amounts carried forward,	<hr/> \$347.84.2 \$634.50.0

Amounts brought forward,	\$347.84.2	\$634.50.0
Third payment, Feb. 11, 1835, . . .	200.00.0	
Interest from Feb. 11, 1835, to Aug. 1, 1835, 5mo. 20da.	5.66.6	
Fourth payment, April 19, 1835, . . .	40.00.0	
Interest from April 19, 1835, to Aug. 1, 1835, 3mo. 12da. . . . .	.68.0	<u>594.18.8</u>
Balance remaining due Aug. 1, 1835, . . .		\$40.31.2

5.

Principal, on interest from June 17, 1829, . . .	\$769.87.0
Interest from June 17, 1829, to March 1, 1830, 8mo. 14da.	<u>32.59.1</u>
Amount,	802.46.1
First payment, March 1, 1830,	<u>75.50.0</u>
New principal, bearing interest from Mar. 1, 1830, . . .	726.96.1
Interest from March 1, 1830, to June 11, 1831, 15mo. 10d.	<u>55.73.3</u>
Amount,	782.69.4
Second payment, June 11, 1831,	<u>165.00.0</u>
New principal, bearing interest from June 11, 1831, . . .	617.69.4
Interest from June 11, 1831, to Sept. 15, 1831, 3mo. 4da.	<u>9.67.7</u>
Amount,	627.37.1
Third payment, Sept. 15, 1831,	<u>161.00.0</u>
New principal, bearing interest from Sept. 15, 1831, carried forward,	\$466.37.1

Amount brought forward,	\$466.37.1
Interest from Sept. 15, 1831, to Jan. 21, 1832,	
4mo. 6da.	9.79.3
Amount,	<u>476.16.4</u>
Fourth payment, January 21, 1832,	<u>47.25.0</u>
New principal, bearing interest from Jan. 21, 1832, 428.91.4	
Interest from Jan. 21, 1832, to Dec. 6, 1833,	
22mo. 15da.	48.25.2
Amount,	<u>477.16.6</u>
Fifth payment, less than interest, March 5, 1833,	12.17
Sixth payment, more than interest, Dec. 6, 1833,	98.00
	<u>110.17.0</u>
New principal, bearing interest from Dec. 6, 1833, 366.99.6	
Interest from Dec. 6, 1833, to July 7, 1834, 7mo. 1d.	12.90.6
Amount,	<u>379.90.2</u>
Seventh payment, July 7, 1834,	<u>169.00.0</u>
New principal, bearing interest from July 7, 1834, 210.90.2	
Interest from July 7, 1834, to Sept. 25, 1835,	
14mo. 18da.	15.39.5
Balance due Sept. 25, 1835,	<u>\$226.29.7</u>

6.

Principal, on interest from April 30, 1831, . . .	\$300.00.0
Interest from April 30, 1831, to June 27, 1832,	
13mo. 27da.	20.85.0
Amount carried forward,	<u>\$320.85.0</u>

Amount brought forward,	8320.85.0
First payment, June 27, 1832,	150.00.0
New principal, bearing interest from June 27, 1832,	170.85.0
Interest from June 27, 1832, to Dec. 9, 1832,	
5mo. 12da.	4.61.2
Amount,	175.46.2
Second payment, Dec. 9, 1832,	150.00.0
New principal, bearing interest from Dec. 9, 1832,	25.46.2
Interest from Dec. 9, 1832, to Oct. 9, 1833, 10mo.	1.27.3
Balance due Oct. 9, 1833,	826.73.5

7.

Principal, on interest from Feb. 11, 1832,	854.18.0
Interest from Feb. 11, 1832, to July 11, 1833,	
17mo.	4.60.5
Amount,	58.78.5
First payment, July 11, 1833,	12.25.0
Principal, bearing interest from July 11, 1833,	46.53.5
Interest from July 11, 1833, to Aug. 21, 1835,	
25mo. 10da.	5.89.4
Amount,	52.42.9
Second payment, less than interest, Aug. 15, 1834,	2.10.0
Third payment, less than interest, July 9, 1835,	3.12.0
Amounts carried forward,	85.22.0
	852.42.9
	8 *

Amounts brought forward,	\$5.22.0	\$52.42.9
Fourth payment, more than interest, Aug.		
21, 1835,	37.18.0	<u>42.40.0</u>
Principal, bearing interest from Aug. 21, 1835,	10.02.9	
Interest from Aug. 21, 1835, to Dec. 17, 1835,		
3mo. 26da. . . . .	.19.3	<u></u>
Balance due, Dec. 17, 1835,	<u>\$10.22.2</u>	

8.

Principal, on interest from Jan. 7, 1831, . . .	\$1728.00.0
Interest from Jan. 7, 1831, to Feb. 9, 1832,	
13mo. 2da.	112.89.6
Amount,	<u>1840.89.6</u>
First payment, Feb. 9, 1832,	<u>760.28.5</u>
Principal, bearing interest from Feb. 9, 1832, .	1080.61.1
Interest from Feb. 9, 1832, to Dec. 28, 1833,	
22mo. 19da.	122.28.9
Amount,	<u>1202.90.0</u>
Second payment, less than interest, Mar.	
5, 1833,	68.50
Third payment, more than interest, Dec.	
28, 1833,	876.28
Amount,	<u>944.78.0</u>
Principal, bearing interest from Dec. 28, 1833, .	258.12.0
Interest from Dec. 28, 1833, to July 17, 1834,	
6mo. 19da.	8.56.0
Amount carried forward,	<u>\$266.68.0</u>

Amount brought forward,	.....	\$266.68.0
Fourth payment, July 17, 1834,	.....	<u>60.00.0</u>
Principal, bearing interest from July 17, 1834,	. . . . .	206.68.0
Interest from July 17, 1834, to Oct. 1, 1834, 2mo. 14da.	.....	<u>2.54.9</u>
Balance due Oct. 1, 1834,	.....	\$209.22.9

9.

Principal, on interest from May 7, 1829,	.....	\$500.00.0
Interest from May 7, 1829, to June 29, 1830, 13mo. 22da.	.....	<u>34.33.3</u>
Amount,	.....	534.33.3
First payment, June 29, 1830,	.....	<u>100.00.0</u>
New principal, carrying interest from June 29, 1830, . . . . .	.....	434.33.3
Interest from June 29, 1830, to Dec. 5, 1831, 17mo. 6da.	.....	<u>37.35.2</u>
Amount,	.....	471.68.5
Second payment, Dec. 5, 1831,	.....	<u>100.00.0</u>
New principal carrying interest from Dec. 5, 1831,	371.68.5	
Interest from Dec. 5, 1831, to July 4, 1833, 18mo. 29da.	.....	<u>35.24.8</u>
Amount,	.....	406.93.3
Third payment, March 12, 1832, less than interest, . . . . .	.....	5.00
Fourth payment, July 4, 1833, more than interest, . . . . .	.....	<u>95.00</u>
New principal, carrying interest from July 4, 1833, carried forward,	.....	<u>\$306.93.3</u>

Amount brought forward,	\$.306.93.3
Interest from July 4, 1833, to Dec. 1, 1834,	
16mo. 27da.	25.93.6
Amount,	<u>\$.332.86.9</u>
Fifth payment, Dec. 1, 1834,	200.00.0
New principal, carrying interest from Dec. 1, 1834,	132.86.9
Interest from Dec. 1, 1834, to Jan. 1, 1836, 13mo.	8.63.6
Balance due Jan. 1, 1836,	<u>\$.141.50.5</u>

10.

Principal, on interest from March 19, 1831,	\$.89.75.0
Interest from March 19, 1831, to Dec. 6, 1831,	
8mo. 17da.	3.84.4
Amount,	<u>93.59.4</u>
First payment, Dec. 6, 1831,	12.12.0
New principal, bearing interest from Dec. 6, 1831,	81.47.4
Interest from Dec. 6, 1831, to Feb. 17, 1832,	
2mo. 11da.	.96.4
Amount,	<u>82.43.8</u>
Second payment, Feb. 17, 1832,	12.12.0
New principal, bearing interest from Feb. 17, 1832,	70.31.8
Interest from Feb. 17, 1832, to Jan. 1, 1835, 34mo. 14da.	<u>12.11.8</u>
Amount carried forward,	<u>\$.892.43.6</u>

Amount brought forward,	\$82.43.6
Third payment, March 19, 1833, less than interest,	3.16
Fourth payment, Dec. 28, 1834, less than interest,	2.18
Fifth payment, Jan. 1, 1835, more than interest,	25.25
	_____ 30.59.0
New principal, bearing interest from Jan. 1, 1835,	51.84.6
Interest from Jan. 1, 1835, to March 11, 1835, 2mo. 10da. . . . .	.60.4
Amount,	52.45.0
Sixth payment, March 11, 1835,	31.18.0
New principal, bearing interest from Mar. 11, 1835,	21.27.0
Interest from March 11, 1835, to July 17, 1835, 4mo. 6da. . . . .	.44.6
Amount,	21.71.6
Seventh payment, July 17, 1835,	5.18.0
New principal, bearing interest from July 17, 1835,	16.53.6
Interest from July 17, 1835, to Sept. 1, 1835, 1mo. 14da. . . . .	.12.1
Amount,	16.65.7
Eighth payment, Sept. 1, 1835,	6.29.0
New principal, bearing interest from Sept. 1, 1835,	10.36.7
Interest from Sept. 1, 1835, to Dec. 29, 1835, 3mo. 28da. . . . .	.20.3
Balance due Dec. 29, 1835,	\$10.57.0

	11.	
Principal carrying interest from Jan 1, 1840, . . .	\$ 1000.00	
Interest from Jan. 1, 1840, to Sept. 28, 1840, 8mo.		
27da.	51.91	
Amount,	1051.91	
First payment,	144.00	
Balance for new principal,	907.91	
Interest from Sept. 28, 1840, to July 17, 1841,		
9mo. 18da.	51.01	
Amount,	958.92	
Second payment, March 1, 1841, a sum less than interest,	\$ 20.00	
Third payment, July 17, 1841, a sum greater than interest,	360.00	380.00
Balance for new principal,	578.92	
Interest from July 17, 1841, to Aug. 9, 1841, 20da.	2.47	
Amount,	581.39	
Fourth payment, Aug 9, 1841,	190.00	
Balance for new principal,	391.39	
Interest from Aug. 9, 1841, to Sept. 25, 1842, 1y.		
1mo. 16da.	30.89	
Amount,	422.28	
Fifth payment, Sept. 25, 1842,	170.00	
Balance for new principal,	252.28	
Interest from Sept. 25, 1842, to Dec. 11, 1843, 1y.		
2mo. 16da.	21.38	
Amount,	273.66	
Sixth payment, Dec. 11, 1843,	200.00	
Balance for new principal, carried forward,	73.66	

Amount brought forward,	873.66
Interest from Dec. 11, 1843, to July 4, 1845, 1y.	
6mo. 23da.	8.06
Amount,	<u>81.72</u>
Seventh payment, July 4, 1845,	75.00
Balance for new principal,	6.72
Interest from July 4, 1845, to June 1, 1847, 1y.	
10mo. 27da. . . . .	.89
Balance due at the time of payment,	<u>87.61</u>

NOTE. — Interest on the above note is computed at 7 per cent.

SECTION XXXIX.

MISCELLANEOUS PROBLEMS IN INTEREST.

2. (p. 181.) $\$120 \times .01 = 1.20 \times 1\frac{1}{2} = 1.60$; $133.20 - 120 = 13.20 \div 1.60 = 8\frac{1}{4}$ per cent. Ans.
3. $\$280 \times .01 = 2.80 \times 6\frac{1}{2} = 18.20$; $411.95 - 280 = 131.95 \div 18.20 = 7\frac{1}{4}$ per cent. Ans.
5. $\$120 \times .08\frac{1}{4} = 9.90$; $133.20 - 120 = 13.20 \div 9.90 = 1\frac{1}{3}\text{y.} = 16$ months, Ans.
6. $\$280 \times .07\frac{1}{4} = 20.30$; $411.95 - 280 = 131.95 \div 20.30 = 6\frac{1}{4}$ years, Ans.
8. $\$1.00 \times .08\frac{1}{4} = .0825 \times 1\frac{1}{2} = .11$; $13.20 + .11 = \$120.00$ Ans.
9. $.07\frac{1}{4} = .0725 \times 6\frac{1}{2} = .47125 + 1 = 1.47125$; $411.95 \div 1.47125 = \$280.00$ Ans.

SECTION XL.

COMPOUND INTEREST.

2. (p. 183.)	3.	4.
5 0 0	3 4 5	3 1 6
.0 6	.0 6	.0 6
<u>3 0 0 0</u>	<u>2 0 7 0</u>	<u>1 8 9 6</u>
5 0 0	3 4 5	3 1 6
<u>5 3 0</u>	<u>3 6 5 7 0</u>	<u>3 3 4 9 6</u>
.0 6	.0 6	.0 6
<u>3 1 8 0</u>	<u>2 1 9 4 2 0</u>	<u>2 0 0 9 7 6</u>
5 3 0	3 6 5 7 0	3 3 4 9 6
<u>5 6 1 8 0</u>	<u>3 8 7 6 4 2</u>	<u>3 5 5 0 5 7</u>
.0 6	.0 6	.0 6
<u>3 3 7 0 8 0</u>	<u>2 3 2 5 8 5 2</u>	<u>2 1 3 0 3 4 2</u>
5 6 1 8 0	3 8 7 6 4 2	3 5 5 0 5 7
<u><u>\$ 5 9 5 5 0 8 0</u></u>	<u><u>Ans. 4 1 0 9 0 0</u></u>	<u><u>3 7 6 3 6 0</u></u>
	.0 6	.0 2 3
	<u>2 4 6 5 4 0</u>	<u>1 1 2 9 0 8 0</u>
	<u>4 1 0 9 0</u>	<u>7 5 2 7 2 0</u>
	<u>4 3 5 5 5 4</u>	<u>8 6 5 6 2 8 0</u>
	.0 6	3 7 6 3 6
	<u>2 6 1 3 3 2 4</u>	<u>3 8 5 0 1 6</u>
	<u>4 3 5 5 5 4</u>	3 1 6.
	<u>4 6 1 6 8 7</u>	<u><u>\$ 6 9 0 1</u></u> Ans.
	.0 6	
	<u>2 7 7 0 1 2 2</u>	
	<u>4 6 1 6 8 7</u>	
	<u>4 8 9 3 8 8</u>	
	.0 6	(Brought up.)
	<u>2 9 3 6 3 2 8</u>	3 2 9 9 2 5 6
	<u>4 8 9 3 8 8</u>	5 4 9 8 7 6
	<u>5 1 8 7 5 1</u>	5 8 2 8 6 8
	.0 6	.0 6
	<u>3 1 1 2 5 0 6</u>	<u>3 4 9 7 2 0 8</u>
	<u>5 1 8 7 5 1</u>	<u>5 8 2 8 6 8</u>
	<u>5 4 9 8 7 6</u>	<u>6 1 7 8 4 0</u>
	.0 6	3 4 5.
	<u><u>\$ 2 9 9 2 5 6</u></u>	<u><u>\$ 2 7 2 8 4</u></u> Ans.

6.
5.743491 = Amount of \$1 for 30 years.
890

$$\begin{array}{r}
 51691419 \\
 45947928 \\
 \hline
 511170699 \\
 890 \\
 \hline
 \$422170,6 \text{ Ans.} \quad 41142868 \\
 \hline
 \$4937.14,416 \text{ Ans.}
 \end{array}$$

7.
10.285717 = Amount of \$1
480 [for 40 years.

8.
1.790847 = Amount of \$1 for 10 years.
.037 $\frac{1}{2}$ = Ratio for 7 months 15 days.

$$\begin{array}{r}
 12535929 \\
 5372541 \\
 \hline
 895423 \\
 \hline
 .067156762 \\
 1.790847 \\
 \hline
 1.858003762 \\
 300 \\
 \hline
 557.40,11286 \\
 300 \\
 \hline
 \$257.40,1 \text{ Ans.}
 \end{array}$$

9.
1.795856 = Amount of \$1 for 12 years.
.009 $\frac{1}{2}$ = Ratio for 1 month 29 days at
[6 per cent.

$$\begin{array}{r}
 16162704 \\
 1496545 \\
 \hline
 \frac{1}{6}) .017659249 \\
 2943208 \\
 \hline
 .014716041 \\
 1.795856 \\
 \hline
 1.810572041 = \text{Amount at 5 per cent.}
 \end{array}$$

$$\begin{array}{r}
 10863432246 \\
 14484576328 \\
 9052860205 \\
 \hline
 \$1060.99,5216026 \text{ Ans.}
 \end{array}$$

10.

$$4) \underline{2,500,000} \quad \text{We add to the principal one fourth}\\
\quad \underline{625,000} \quad \text{of its sum, because 25 per cent. is}\\
4) \underline{3,125,000} \quad \text{one fourth of the principal.}\\
\quad \underline{781,250}$$

$$4) \underline{3,906,250} \\
\quad \underline{976,562}$$

$$4) \underline{4,882,812} \\
\quad \underline{1,220,703}$$

$$4) \underline{6,103,515} \\
\quad \underline{1,525,878}$$

$$4) \underline{7,629,393} \\
\quad \underline{1,907,348}$$

$$4) \underline{9,536,741} \\
\quad \underline{2,384,185}$$

$$4) \underline{11,920,926} \\
\quad \underline{2,980,231}$$

$$4) \underline{14,901,157} \\
\quad \underline{3,725,289}$$

$$4) \underline{18,626,446} \\
\quad \underline{4,656,611}$$

$$\underline{23,283,057} \text{ Ans.}$$

11.

$$\begin{array}{r} 2,500,000 \\ .02 \\ \hline 50,000. \text{ Ans.} \end{array}$$

12.

$$\begin{array}{r} 1.407100 \\ 900 \\ \hline \end{array}$$

$$\$ 1266.39 \text{ Ans.}$$

13.

1.191016 = Amount of \$1 for 3 years.
 $.019$ = Ratio for 3 months, 24 days.

$$\begin{array}{r} 10719144 \\ 1191016 \\ \hline .022629304 \\ 1.191016 \end{array}$$

$\underline{1.213645304}$ = Amount of \$1 for 3 years, 3
 $\quad \quad \quad 350$ [months, 24 days.]

$$\begin{array}{r} 60682265200 \\ 3640935912 \\ 424775856400 \\ 350. \end{array}$$

$\underline{\$ 7477.5+}$ = Compound interest of the principal for
[do.]

^{14.}

1.1 2 3 6 = Amount of \$ 1 for 2 years.

.0 4 9 = Ratio for 9 months and 24 days.

1 0 1 1 2 44 4 9 4 4.0 5 5 0 5 6 41.1 2 3 6

1.1 7 8 6 5 6 4 = Amount of \$ 1 for 2y. 9mo. 24d.

9 7 08 2 5 0 5 9 4 8 01 0 6 0 7 9 0 7 61 1 4 3 2 9 6 7 0 89 7 0.

\$ 1 7 3.2 9,6 Ans. = Compound interest of the principal for do.

^{15.}

Principal, bearing interest from Jan. 1, 1830, . . . \$ 500.00,0

Compound interest on \$ 500 from Jan. 1, 1830, to

Sept. 1, 1834, 4y. 8mo. 156.48,7Amount of the principal to Sept. 1, 1834, 656.48,7

First payment, July 16, 1830, \$ 200.00,0

Compound interest from July 16, 1830,

to Sept. 1, 1834, 4y. 1mo. 15d. 54.38,8

Second payment, Aug. 21, 1831, 200.00,0

Compound interest from Aug. 21, 1831,

to Sept. 1, 1834, 3y. 0mo. 10d. 38.59,9

Third payment, Dec. 1, 1832, 100.00,0

Compound interest from Dec. 1, 1832,

to Sept. 1, 1834, 1y. 9mo. 10.77,0Amount of the indorsements, 603.75,7Balance due Sept. 1, 1834, \$ 52.73,0

16.

Principal, bearing interest from March 25, 1834,	\$ 100.00,0
Interest for 1y. 5mo.	8.65,0
Amount of the principal to Aug. 25, 1835, . . .	108.65,0
First payment, June 11, 1834, . . .	\$ 50.00,0
Compound interest from June 11, 1834, to Aug. 25, 1835, 14mo. 14d. . . .	3.65,3
Second payment, Sept. 25, 1834, . . .	50.00,0
Compound interest from Sept. 25, 1834, to Aug. 25, 1835, 11mo.	2.75,0
Amount of the indorsements,	<u>106.40,3</u>
Balance due Aug. 25, 1835,	\$ 2.24,7

17.

Principal, bearing interest from Jan. 1, 1840, . .	\$ 1000.00
Compound interest on \$ 1000 from Jan. 1, 1840, to April 1, 1845, 5y. 3mo.	427.09
Amount of principal to April 1, 1845,	<u>1427.09</u>
First payment, June 10, 1840,	\$ 70.00
Compound interest from June 10, 1840, to April 1, 1845, 4y. 9mo. 21d. . . .	26.94
Second payment, Sept. 25, 1841,	80.00
Compound interest from Sept. 25, 1841, to April 1, 1845, 3y. 6mo. 6d. . . .	21.54
Third payment, July 4, 1842,	100.00
Compound interest from July 4, 1842, to April 1, 1845, 2y. 8mo. 27d. . . .	20.43
Fourth payment, Nov. 11, 1843,	30.00
Compound interest from Nov. 11, 1843, to April 1, 1845, 1y. 4mo. 20d. . . .	2.97
Amounts carried forward,	<u>\$ 351.88</u> <u>\$ 1427.09</u>

Amounts brought forward,	\$ 351.88	\$ 1427.09
Fifth payment, June 5, 1844,	50.00	
Compound interest from June 5, 1844, to April 1, 1845, 9mo. 26d.	<u>2.87</u>	
Amount of indorsements,		<u>404.75</u>
Balance due April 1, 1845,		<u>\$ 1022.34</u>

NOTE.— The above note and indorsements are reckoned at 7 per cent.

18.

Principal, bearing compound interest at 5 per cent. from July 4, 1841,	\$ 1700.00,0
Compound interest at 5 per cent. from July 4, 1841, to July 4, 1847, 6y.	<u>578.16,0</u>
Amount of the principal to July 4, 1847,	<u>2278.16,0</u>
Payment, Sept. 1, 1843,	<u>\$ 1000.00,0</u>
Compound interest at 5 per cent. from Sept. 1, 1843, to July 4, 1847, 3y. 10mo. 3d.	<u>206.34,1</u>
Amount of the indorsement,	<u>1206.34,1</u>
Balance due July 4, 1847,	<u>\$ 1071.81,9</u>

SECTION XLI.

DISCOUNT.

2. (p. 187.) \$ 1.12 amount of \$ 1 for the given time ;
 $\$ 117.60 \div 1.12 = \$ 105.00$ Ans.
3. \$ 1.07 amount of \$ 1 for the given time ; \$ 802.50 +
1.07 = \$ 750 ; \$ 802.50 — 750 = \$ 52.50 Ans.
4. \$ 1.205 amount of \$ 1 for 3y. 5mo. ; \$ 769.60 + 1.205
= \$ 638.67,2₂₄⁸ Ans.
5. \$ 1.46,8₃ amount of \$ 1 for 7y. 9mo. 20d. ; \$ 986.40 +
1.46,8₃ = \$ 671.78,2₈₈⁵ Ans.

6. $\frac{1}{8}$ = amount, $\frac{1}{8}$ = principal, $\frac{1}{8}$ = discount. Therefore,
 $32 \times 16 = 512 \div 15 = 34\frac{2}{5}$ qt. Ans.
7. \$ 1.26875 amount of \$ 1 for 3y. 7mo.; \$ 678.75 \div
 $1.26875 = \$ 534.97,5\frac{1}{2}\frac{1}{3}$ Ans.
8. \$ 1.091 $\frac{1}{8}$ amount of \$ 1 for 18mo. 11d.; \$ 1000 \div
 $1.091\frac{1}{8} = \$ 915.89,4\frac{1}{8}\frac{1}{4}$ Ans.
9. \$ 1.017 $\frac{1}{8}$ amount of \$ 1 for 3mo. 16d.; \$ 715.50 \div
 $1.017\frac{1}{8} = \$ 703.07,8\frac{1}{8}\frac{1}{8}$ Ans.
10. \$ 1.054 amount of \$ 1 for 10mo. 24d.; \$ 914.75 \div
 $1.054 = \$ 867.88,4\frac{1}{2}\frac{1}{2}$ Ans.
11. \$ 1.056 $\frac{1}{8}$ amount of \$ 1 for 11mo. 11d.; \$ 79.87 \div
 $1.056\frac{1}{8} = \$ 75.57,4+$.
\$ 1.111 $\frac{1}{8}$ amount of \$ 1 for 22mo. 7d.; \$ 87.75 \div 1.111 $\frac{1}{8}$
 $= \$ 78.97,1 + \$ 75.57,4 = \$ 154.54,5+$ Ans.
12. \$ 1.250 $\frac{1}{4}$ amount of \$ 1 for 50mo. 3d.; \$ 1728 \div 1.250 $\frac{1}{4}$
 $= \$ 1381.84,7\frac{1}{2}\frac{1}{4}$ Ans.
13. \$ 5.00 \times 1.10 = \$ 5.50; \$ 1.00 — .10 = .90; 5.50 \div
.90 = \$ 6.11 $\frac{1}{8}$ Ans.
14. \$ 1.118 amount of \$ 1 for 23mo. 18d.; \$ 365.87 \div
1.118 = \$ 327.25,4+.
\$ 1.1525 amount of \$ 1 for 30mo. 15d.; \$ 161.15 \div
1.1525 = \$ 139.82,6+.
- \$ 1.028 $\frac{1}{8}$ amount of \$ 1 for 5mo. 22d.; \$ 112.50 \div
1.028 $\frac{1}{8}$ = \$ 109.36,4+.
- \$ 1.258 amount of \$ 1 for 51mo. 18d.; \$ 96.81 \div
1.258 = \$ 76.95,5+.
- \$ 327.25,4 + \$ 139.82,6 + \$ 109.36,4 + \$ 76.95,5+
= \$ 653.40+ Ans.

SECTION XLII.

PER CENTAGE.

1. (p. 188.)	\$ 1555.20.	3.	1296 barrels.
2.	\$ 7.20.	4.	414 men.

5.	\$ 1468.80.	11.	665 chaldrons.
6.	Wife, \$ 10,000 ; son, \$ 4,500 ; daughters, \$ 3,480 each.	12.	.8 miles.
7.	75 bushels.	13.	\$ 990.
8.	15cwt.	14.	48 barrels.
9.	45 tons.	15.	60 hogsheads.
10.	\$ 375.	16.	\$ 0.25.
		17.	15.12 pounds.

SECTION XLIII.

COMMISSION AND BROKERAGE.

1. (p. 190.) $\$18,768 \times .01\frac{1}{2} = \328.44 Ans.
2. $\$896 \times .02 = \17.92 Ans.
3. $395\text{£. }15\text{s. }5\text{d. } \times .02\frac{1}{4} = 8\text{£. }18\text{s. }1\frac{65}{100}\text{d. }$ Ans.
4. $\$1976 \times \frac{18}{24} = \1900 Ans.
5. $\$7658.75 \times .015 = \$114.88\frac{1}{2}$ Ans.
6. $\$107.75 \times 37 = \3986.75 ; $\frac{1}{2}$ per cent. = .00375;
 $\$3986.75 \times .00375 = \$14.95\frac{1}{2}$ Ans.
7. $\$112.25 \times 12 = \1347.00 ; $\frac{1}{2}$ per cent. = .0025;
 $\$1347.00 \times .0025 = \$3.36\frac{1}{2}$ Ans.
8. $\$12.25 \times 700 = \8575.00 ; $1\frac{1}{4}$ per cent. = .0175;
 $\$8575.00 \times .0175 = \$150.06\frac{1}{4}$ Ans.
9. $\$8960.00 \times \frac{2}{15} = \$175.68\frac{1}{4}$ Ans.
10. $\$5.75 \times 700 = \4025.00 ; $1\frac{1}{4}$ per cent. = .0175;
 $\$4025.00 \times .0175 = \$70.43\frac{1}{4}$ Ans.
11. $\$8.95 \times 173 = \1548.35 ; $1\frac{1}{4}$ per cent. = .01875;
 $\$1548.35 \times .01875 = \$29.03\frac{1}{2}$ Ans.
12. $879\text{£. }12\text{s. }9\text{d. } \times .03\frac{1}{2} = 29\text{£. }13\text{s. }9\frac{1}{2}\text{d. }$ Ans.
13. $987\text{£. }18\text{s. }6\text{d. } \times .0225 = 22\text{£. }4\text{s. }6\frac{1}{2}\text{d. } = 965\text{£. }13\text{s. }11\frac{1}{2}\text{d. } ; 965\text{£. }18\text{s. }6\text{d. } - 22\text{£. }4\text{s. }6\frac{1}{2}\text{d. } = 96569\text{£. }18\text{s. }4\frac{1}{2}\text{d. } ; 96569\text{£. }18\text{s. }4\frac{1}{2}\text{d. } \div 101\frac{1}{2} = 947\text{£. }18\text{s. }5\frac{1}{2}\text{d. } ; 947\text{£. }18\text{s. }5\frac{1}{2}\text{d. }$

$$\div 1\text{£. } 3\text{s. } 8\text{d.} = 185413764 \div 231460 = 801\frac{3576}{57885}$$

yards, Ans.

The pupil will perceive, that, in the latter part of the operation of this question, the pounds, shillings, and pence are reduced to 815ths of a penny.

$$14. \$102.50 \times 90 = \$9225 \div 2\frac{1}{2} = \$3690, \text{ the sum remitted; } \$3690 - \$90 = \$3600 \div 95 = 37\text{T. } 17\text{cwt. } 3\text{qr. } 16\frac{4}{5}\text{lb. Ans.}$$

SECTION XLIV.

STOCKS.

2. (p. 191.) $\$100 \times 15 = \$1500 \times 1.13 = \$1695$ Ans.
 3. $\$100 \times 12 = \$1200 \times 1.15 = \$1380$ Ans.
 4. $1058\text{£. } 12\text{s.} \times 1.15\frac{1}{4} = 1225\text{£. } 6\text{s. } 7\frac{2}{5}\text{d.}$ Ans.
 5. $\$100 \times 30 = \$3000 \times 1.08\frac{1}{4} = \3262.50 Ans.
 6. $\$100 \times 10 = \$1000 \times .85 = \$850$ Ans.
 7. $\$100 \times 5 = \$500 \times 1.07 = \$535$ Ans.
-

SECTION XLV.

INSURANCE AND POLICIES.

1. (p. 192.) $1\frac{3}{4}$ per cent. = .0175 ; $\$5728 \times .0175 = \100.24 Ans.
2. $1\frac{1}{4}$ per cent. = .0125 ; $\$17,289 \times .0125 = \$216.11\frac{1}{4}$ Ans.
3. $4\frac{1}{4}$ per cent. = .0475 ; $3\frac{7}{8}$ per cent. = .03875 ; $\$10,000 \times .0475 = \475.00 ; $\$12,000 \times .03875 = \465.00 ; $\$10,000 - \$475 = \$9,525$; $\$12,000 - \$465 = \$11,535$; $\$9,525 + \$11,535 = \$21,060$; $\$50,765 - \$21,060 = \$29,705$ Ans.
4. $4\frac{1}{4} + 3\frac{7}{8} + 4\frac{1}{2} + 5 + 5\frac{1}{2} = 23\frac{1}{4}$ per cent. = .23125 ; $\$47,600 \times .23125 = \$11,007.50$ Ans.
5. $\$1728 \times .0725 = \125.28 Ans.

6. $\$35,000 \times \frac{3}{5} = \$21,000$; $\$21,000 \times .0325 = \682.50 ;
 $\$75,000 \times \frac{3}{5} = \$50,000$; $\$50,000 \times .025 = \1250.00 ;
 $\$682.50 + \$1250.00 = \$1932.50$ Ans.
 7. $\$10,000 \times .03375 = \337.50 ; $\$10,000 - \$337.50 =$
 $\$9962.50$; $\$20,000 \times .0475 = \950 ; $\$20,000 -$
 $\$950 = \$19,050$; $\$18,750 + \$37,960 = \$56,710$;
 $\$9962.50 + \$19,050 = \$28,712.50$; $\$56,710 -$
 $\$28,712.50 = \$27,997.50$ Ans.
 8. $\$3675 \times .04875 = \$179.15\frac{1}{2}$ Ans.
 9. $\$896 \times .12 = \107.52 Ans.
 10. $\$850 \times .18\frac{1}{2} = \157.25 Ans.
 11. $\$9870 \times .07 = \690.90 Ans.
 12. $\$1.00 - .15 = .85$; $\$1728 \times .85 = \1468.80 Ans.
 13. $\$1.00 - .10 = .90$; $\$2475 \div .90 = \2750 Ans.
 14. $\$1.00 - .12\frac{1}{2} = .87\frac{1}{2}$; $\$26,250 \div .87\frac{1}{2} = \$30,000$ Ans.
 15. $\$3600 \times .60 = \2160 Ans.
 16. $\$1.00 - .10 = .90$; $\$600 \times .90 = \540 Ans.
 17. $\$1.00 - .03 = .97$; $\$1000 \div .97 = \$1030.92,7+$.
 $\$1.00 - .05 = .95$; $\$1030.92,7 \div .95 = \$1085.18,7+$.
 $\$1.00 - .06 = .94$; $\$1085.18,7 \div .94 = \$1154.45,4+$.
 $\$1.00 - .07 = .93$; $\$1154.45,4 \div .93 = \$1241.34,8+$
Ans.
-

SECTION XLVI.

BANKING.

1. (p. 194.) $\$476 \times .005\frac{1}{2} = \$2.61,8$ Ans.
 2. $\$1000 \times .010\frac{1}{2} = \10.50 Ans.
 3. $\$7800 \times .015\frac{1}{2} = \120.90 Ans.
 4. $\$8000 \times .010\frac{1}{2} = \84.00 Ans.
 5. $\$760 \times .025\frac{1}{2} = \19.88 ; $\$760 - \$19.88 = \$740.62$
Ans.
 6. $\$1728 \times .015\frac{1}{2} = \$26.78,4$; $\$1728 - \$26.78,4 =$
 $\$1701.21,6$ Ans.
 7. $\$7860 \times .030\frac{1}{2} = \239.73 ; $\$7860 - \$239.73 =$
 $\$7620.27$ Ans.
-

8. $\$3.50 \times 450 = \1575 , price for which the fish were bought.
 $\$4.00 \times 450 = \1800 , price for which they were sold.
 $\$1800 \times .030\frac{1}{2} = \54.90 ; $\$1800 - \$54.90 = \$1745.10$, received at the bank.
 $\$1745.10 - \$1575 = \$170.10$, gain on the fish, Ans.
-

SECTION XLVII.

BARTER.

1. (p. 195.) $760 \times 8 = 6080 \div 12\frac{1}{2} = 486\frac{2}{5}$ lb. Ans.
2. $760 \times 62\frac{1}{2} = 47500 \div 17 = 2794\frac{2}{17}$ lb. Ans.
3. $3 \times 63 \times 1.10 = 207.90 \div 126 = \1.65 Ans.
4. $12 \times 112 \times 8 = 10752 \div 196 = \$0.54\frac{4}{7}$ per lb. Ans.
5. 17cwt. 3qr. 4lb. = 1992lb.; $41 \times 6.70 = \$274.70 - \$88 = \$186.70 \div 1992 = \$0.09\frac{3}{5}\frac{1}{4}$ Ans.
6. B's tea cost him 40 cents per lb., and he sells it for 50 cents per lb.; his gain, therefore, is $\frac{1}{4}$ of the principal, or 25 per cent. A's gain is 4 cents on the lb., and his gain, to be in proportion to B's, must be $\frac{1}{4}$ of the principal; A's sugar, therefore, will be $4 \times 4 = 16$ cents per lb., Ans.
7. $15 \times 63 \times 1.25 = \$1181.25 \div 25 = 47\frac{1}{4}$ M. staves, Ans.
8. As Q bought his oats for 35 cents per bushel, and sold them at 50 cents, his gain per cent. is $50 - 35 = 15$; $\frac{15}{50} = \frac{3}{10}$ of the cost. If, therefore, we add $\frac{3}{10}$ of the cost of Z's flour to \$5.00, we have his bartering price; thus, $\frac{3}{10}$ of \$5.00 = \$2.14 $\frac{2}{7}$; $\$2.14\frac{2}{7} + \$5.00 = \$7.14\frac{2}{7}$ per barrel; and $670 \times .50 = \$335 \div \$7.14\frac{2}{7} = 46\frac{9}{10}$ barrels of flour, Ans.
9. 7s. = 84d.; 6s. 8d. = 80d.; $\frac{84}{8} = \frac{21}{2}$; $100 \times \frac{21}{2} = 95\frac{5}{2}$ per cent.; 7s. 6d. = 90d.; 7s. 3d. = 87d.; $\frac{87}{90} = \frac{29}{30}$; $100 \times \frac{29}{30} = 96\frac{2}{3}$ per cent.; $96\frac{2}{3} - 95\frac{5}{2} = 1\frac{1}{6}$ per cent. Ans. That is, Samuel Jenkins will lose $1\frac{1}{6}$ per cent. on his corn.

SECTION XLVIII.

PRACTICE.

$$6d. = \frac{1}{2}) \underline{387s. 0d.} \stackrel{6. (p. 198.)}{=} \text{price at 1s.}$$

$$3d. = \frac{1}{2}) \underline{193 \quad 6} \stackrel{6. (p. 198.)}{=} \text{price at 6d.}$$

$$\underline{96 \quad 9} \stackrel{6. (p. 198.)}{=} \text{price at 3d.}$$

$$20) \underline{290 \quad 3}$$

Ans. 14s. 10s. 3d. = price at 9d.

$$2s. 6d. = \frac{1}{2}) \underline{498s. 0s. 0d.} \stackrel{7.}{=} \text{value at 1s. per lb.}$$

$$\text{Ans. } 62s. 5s. 0d. = \text{value at 2s. 6d.}$$

$$4s. = \frac{1}{2}) \underline{384s.} \stackrel{8.}{=} \text{value at 1s. per yd.}$$

$$6d. = \frac{1}{2}) \underline{76 \quad 16 \quad 0} = \text{value at 4s.}$$

$$3d. = \frac{1}{2}) \underline{9 \quad 12 \quad 0} = \text{value at 6d.}$$

$$\underline{4 \quad 16 \quad 0} = \text{value at 3d.}$$

Ans. 91s. 4s. 0d. = value at 4s. 9d.

$$10s. = \frac{1}{2}) \underline{714s.} \stackrel{9.}{=} \text{value at 1s. per yd.}$$

$$5s. = \frac{1}{2}) \underline{357 \quad 0} = \text{value at 10s.}$$

$$6d. = \frac{1}{10}) \underline{178 \quad 10} = \text{value at 5s.}$$

$$\underline{17 \quad 17} = \text{value at 6d.}$$

Ans. 553s. 7s. = value at 15s. 6d.

$$2qr. = \frac{1}{2}) \$ 2.50 \stackrel{10.}{=} \text{value of 1cwt.}$$

$$\underline{16}$$

$$\underline{40.00} = \text{value of 16cwt.}$$

$$1qr. = \frac{1}{2}) \underline{1.25} = \text{value of 2qr.}$$

$$7lb. = \frac{1}{4}) \underline{.62,5} = \text{value of 1qr.}$$

$$2lb. = \frac{1}{14}) \underline{.15,62} = \text{value of 7lb.}$$

$$1lb. = \frac{1}{2}) \underline{.4,49} = \text{value of 2lb.}$$

$$\underline{2,24} = \text{value of 1lb.}$$

Ans. \\$ 42.09,8+ = value of 16cwt. 3qr. 10lb.

1qr. = $\frac{1}{2}$) \$14 ^{11.}
 27
 $\overline{378}$ = value of 27cwt.

14lb. = $\frac{1}{2}$) 3.50 = value of 1qr.
 7lb. = $\frac{1}{2}$) 1.75 = value of 14lb.
 $\overline{87\frac{1}{2}}$ = value of 7lb.

Ans. \$384.12 $\frac{1}{2}$ = value of 27cwt. 1qr. 21lb.

12.

10cwt. = $\frac{1}{2}$) \$24.60 = value of 1 ton.
 7
 $\overline{172.20}$

2cwt. = $\frac{1}{5}$) 12.30 = value of 10cwt.
 1cwt. = $\frac{1}{2}$) 2.46 = value of 2cwt.
 2qr. = $\frac{1}{2}$) 1.23 = value of 1cwt.
 7lb. = $\frac{1}{2}$) .61.5 = value of 2qr.
 $\overline{7.6\frac{1}{2}}$ = value of 7lb.

Ans. \$188.88.1 $\frac{1}{2}$ = value of 7T. 13cwt. 2qr. 7lb.

13.

2R. = $\frac{1}{2}$) \$80.50 = value of 1 acre.
 25
 $\overline{2012.50}$

20rd. = $\frac{1}{5}$) 40.25 = value of 2 roods.
 10rd. = $\frac{1}{2}$) 10.06.2 $\frac{1}{2}$ = value of 20 rods.
 5rd. = $\frac{1}{2}$) 5.03.1 $\frac{1}{2}$ = value of 10 rods.
 $\overline{2.51.5\frac{1}{2}}$ = value of 5 rods.

Ans. \$2070.35.9 $\frac{1}{2}$ = value of 25A. 2R. 35rd.

14.

$$10\text{rd.} = \frac{1}{15}) \$32.32 = \text{value of } 1\text{A.}$$

$$\begin{array}{r} 51 \\ \hline 3232 \\ 16160 \\ \hline \$1648.32 = \text{value of } 51\text{A.} \end{array}$$

$$5\text{rd.} = \frac{1}{2}) \quad 2.02 = \text{value of } 10\text{rd.}$$

$$1.01 = \text{value of } 5\text{rd.}$$

$$\text{Ans. } \$1651.35 = \text{value of } 51\text{A. } 0\text{R. } 15\text{rd.}$$

15.

$$2\text{qr.} = \frac{1}{2}) \$5.60 = \text{value of } 1\text{yd.}$$

7

$$39.20 = \text{value of } 7\text{yd.}$$

$$1\text{qr.} = \frac{1}{2}) \quad 2.80 = \text{value of } 2\text{qr.}$$

$$2\text{na.} = \frac{1}{2}) \quad 1.40 = \text{value of } 1\text{qr.}$$

$$.70 = \text{value of } 2\text{na.}$$

$$\text{Ans. } \$44.10 = \text{value of } 7\text{yd. } 3\text{qr. } 2\text{na.}$$

16.

$$10 = \frac{1}{10}) \$6780 = \text{principal.}$$

$$2\frac{1}{2} = \frac{1}{4}) \quad 678 = 10 \text{ per cent.}$$

$$169.50 = 2\frac{1}{2} \text{ per cent.}$$

$$\text{Ans. } \$847.50 = 12\frac{1}{2} \text{ per cent.}$$

10

5 per cent. = $\frac{1}{20}$)	<u>\$ 1728.00</u>	^{17.} principal.
1 per cent. = $\frac{1}{100}$)	86.40	interest at 5 per cent.
	17.28	interest at 1 per cent.

6 months = $\frac{1}{2}$)	<u>103.68</u>	interest at 6 per cent.
	5	

1 month = $\frac{1}{12}$)	<u>518.40</u>	interest for 5 years.
15 days = $\frac{1}{4}$)	51.84	interest for 6 months.
5 days = $\frac{1}{3}$)	8.64	interest for 1 month.
	4.32	interest for 15 days.
	1.44	interest for 5 days.

Ans. \$ 584.64 = interest for 5y. 7mo. 20d.

10cwt. = $\frac{1}{2}$)	<u>19£. 19s. 11$\frac{1}{4}$d.</u>	^{18.} = value of 1 ton.
	19	

379	19	$7\frac{1}{4}$	= value of 19 tons.
5cwt. = $\frac{1}{2}$)	9	19	$11\frac{7}{8}$ = value of 10cwt.
4cwt. = $\frac{1}{3}$)	4	19	$11\frac{1}{8}$ = value of 5cwt.
2qr. = $\frac{1}{6}$)	3	19	$11\frac{3}{8}$ = value of 4cwt.
1qr. = $\frac{1}{12}$)	0	9	$11\frac{5}{8}$ = value of 2qr.
14lb. = $\frac{1}{14}$)	0	4	$11\frac{1}{2}\frac{1}{2}$ = value of 1qr.
7lb. = $\frac{1}{28}$)	0	2	$5\frac{1}{2}\frac{1}{2}$ = value of 14lb.
4lb. = $\frac{1}{56}$)	0	1	$2\frac{1}{2}\frac{1}{2}$ = value of 7lb.
2lb. = $\frac{1}{112}$)	0	0	$8\frac{1}{2}\frac{1}{2}$ = value of 4lb.
$\frac{1}{2}$ lb. = $\frac{1}{280}$)	0	0	$4\frac{1}{2}\frac{1}{2}$ = value of 2lb.
	0	0	$1\frac{1}{2}\frac{1}{2}$ = value of $\frac{1}{2}$ lb.

Ans. 399£. 19s. 5 $\frac{1}{2}\frac{1}{2}$ d. = value of 19T. 19cwt.
[3qr. 27 $\frac{1}{2}$ lb.

2fur. = $\frac{1}{2}$)	<u>\$ 18675.</u>	^{19.} = cost of 1 mile.
	14	

261450.	= cost of 14 miles.
1fur. = $\frac{1}{2}$)	4668.75, = cost of 2 furlongs.
20rd. = $\frac{1}{2}$)	2334.37,5 = cost of 1 furlong.
10rd. = $\frac{1}{2}$)	1167.18,7 = cost of 20 rods.
5rd. = $\frac{1}{2}$)	583.59,3 = cost of 10 rods.
10ft. = $\frac{1}{3}$)	291.79,6 = cost of 5 rods.
	35.36,9 = cost of 10 feet.

Ans. \$ 270531.07,0 = cost of 14m. 3fur. 35rd. 10ft.

SECTION XLIX.

EQUATION OF PAYMENTS.

2. (p. 199.) \$50 to be paid in 2 months, is the same as \$100 in 1 month; \$150 in 8 months, is the same as \$100 in 12 months. The equated time, then, will be, as if \$100 were to be paid in 1 month, \$100 in 5 months, and \$100 in 12 months; that is, \$100 in $1 + 5 + 12 = 18$ months; consequently \$300 in $\frac{1}{3}$ of 18 months = 6 months,
Ans.

OPERATION.

$$\begin{array}{r} \$ 50 \times 2 = 100 \\ \$ 100 \times 5 = 500 \\ \$ 150 \times 8 = 1200 \\ \hline \$ 300 \quad 300) \overline{1800} \text{ (6 months, Ans.} \\ \hline 1800 \end{array}$$

3. \$200 to be paid in 3 months, is the same as \$100 in 6 months; and \$300 in 5 months, is the same as \$100 in 15 months; and \$500 in 10 months, is the same as \$100 in 50 months. If, then, \$100 is to be paid in $6 + 15 + 50 = 71$ months, \$1000 should be paid in $\frac{1}{10}$ of 71 months = $\frac{71}{10} = 7\frac{1}{10}$ months, Ans.

OPERATION.

$$\begin{array}{r} \$ 200 \times 3 = 600 \\ \$ 300 \times 5 = 1500 \\ \$ 500 \times 10 = 5000 \\ \hline \$ 1000 \quad 1000) \overline{7100} \text{ (} 7\frac{1}{10} \text{ months, Ans.} \\ \hline 7000 \\ \hline 100 \end{array}$$

4. \$50 for 4 months, is \$1 for 200 months; and \$100 for 8 months, is \$1 for 800 months. If, then, \$1 is to be paid in $200 + 800 = 1000$ months, \$150 should be paid in $\frac{1}{150}$ of 1000 months $= \frac{1000}{150} = 6\frac{2}{3}$ months. It appears, then, that \$150 is paid $6\frac{2}{3}$ months before it is due. The question now is, In how much *less* than 10 months should the \$250 be paid? As we have before shown that \$1 is to be paid in 1000 months, \$250 should be paid in $\frac{1}{250}$ of 1000 months $= 1000 \div 250 = 4$ months. We find, then, that the time in which B is to pay A, is 4 months *less* than it otherwise would have been, on account of A's making present payment. We therefore subtract 4 months from 10, and find the true answer; thus, $10 - 4 = 6$ months, Ans.

OPERATION.

$$\begin{array}{r} 50 \times 4 = 200 \\ 100 \times 8 = 800 \\ \hline 150 \quad 150) 1000 \text{ (} 6\frac{2}{3} \text{ months.} \\ \hline 1000 \end{array}$$

$$150 \times 6\frac{2}{3} = 1000 \div 250 = 4 \text{ months;} \\ 10 - 4 = 6 \text{ months, Ans.}$$

5. As $\frac{1}{2}$ of \$144 is paid 7 months before it is due, it is evident the remainder, \$72, is payable in 14 months; but \$48 of this sum is paid in 4 months, which is 10 months before it is due. There will then remain \$24 unpaid; and the question will be, How long may \$24 be kept to pay the interest of \$72 for 10 months? \$72 for 10 months, is the same as \$1 for 720 months; and \$1 for 720 months, is the same as \$24 for $\frac{1}{24}$ of 720 months $= 720 \div 24 = 30$ months. To the 30 months we add the 4 months, and we have the whole equated time; thus, $30 + 4 = 34$ months $= 2y. 10mo.$ Ans

OPERATION.

$$\underline{144 \times 7 = 1008}$$

$$\begin{array}{r}
 72 \\
 48 \times 4 = 192 \\
 \hline
 120 \quad 24) 816 (34 \text{mo.} = 2 \text{y. } 10 \text{mo. Ans.} \\
 \hline
 24 \qquad \qquad \qquad 72 \\
 \hline
 \qquad \qquad \qquad 96 \\
 \qquad \qquad \qquad 96 \\
 \hline
 \end{array}$$

6. \$133 $\frac{1}{3}$ in 2 months, is the same as \$1 in 266 $\frac{2}{3}$ months; and \$266 $\frac{2}{3}$ in 3 months, is the same as \$1 in 800 months; \$400 in 6 months, is the same as \$1 in 2400 months; and \$1 in 266 $\frac{2}{3}$ + 800 + 2400 = 3466 $\frac{2}{3}$ months, is the same as \$800 for $\frac{1}{3}$ of 3466 $\frac{2}{3}$ months = 3466 $\frac{2}{3}$ \div 800 = 4 $\frac{1}{3}$ months. And if $\frac{1}{2}$ of \$800 be paid down, the remainder, \$400, may be kept twice 4 $\frac{1}{3}$ months = 8 $\frac{2}{3}$ months, Ans.

OPERATION.

$$\begin{array}{r}
 \$133\frac{1}{3} \times 2 = 266\frac{2}{3} \\
 266\frac{2}{3} \times 3 = 800 \\
 400 \times 6 = 2400 \\
 \hline
 800 \quad 400) 3466\frac{2}{3} (8 \text{ months.} \\
 \hline
 400 \qquad \qquad \qquad 3200 \\
 \hline
 400 \qquad \qquad \qquad 266\frac{2}{3} \\
 \qquad \qquad \qquad 30 \\
 \hline
 400) 8000 (20 \text{ days.} \\
 \qquad \qquad \qquad 800 \\
 \hline
 \qquad \qquad \qquad 0
 \end{array}$$

10 *

8. The various parcels of goods will become due as follows:—

May 1,	a bill amounting to	\$600.
July 7,	" "	\$370.
July 15,	" "	\$560
Oct. 20,	" "	\$420

OPERATION.

$$\begin{array}{r}
 \$600 \times 0 = \\
 370 \times 67 = 24790 \\
 560 \times 75 = 42000 \\
 420 \times 172 = \underline{\underline{72240}} \\
 \hline
 \$1950 \quad 1950) 139030 (71\frac{5}{195} \text{ Ans.} \\
 \hline
 \underline{19650} \\
 \hline
 \underline{2530} \\
 \hline
 \underline{1950} \\
 \hline
 \underline{580}
 \end{array}$$

The medium time of payment will therefore be $71\frac{5}{195}$ days, that is, 72 days from May 1, which will be July 11.

NOTE.—Merchants generally prefer the following method:

$$\begin{array}{r}
 \$600 \times 0 \\
 370 \times 2\frac{6}{10} = 814 \\
 560 \times 2\frac{1}{4} = 1381\frac{1}{2} \\
 420 \times 5\frac{1}{8} = 2366 \\
 \hline
 \underline{\underline{\$1950 \quad 1950) 4561\frac{1}{2}}} (2\text{mo. } 10\frac{34}{195}\text{ da. Ans.}
 \end{array}$$

9. The bill will become due as follows:—

June 1, 1845,	a bill for	\$675.25
Nov. 4,	" "	376.18
" 25,	" "	821.75
June 1, 1846,	" "	961.25
April 1,	" "	144.50
Aug. 10,	" "	811.30
" 12,	" "	567.70
" 15,	" "	369.80

\$675.25 × 0

376.18 × 156	=	\$58684.08
821.75 × 177	=	145449.75
961.25 × 365	=	348856.25
144.50 × 304	=	43928.00
811.30 × 435	=	352915.20
567.70 × 437	=	248084.90
369.80 × 440	=	162712.00

\$4727.73 \$4727.73)1360630.48(288.8 days, Ans.

The medium time of payment will, therefore, be 288.8 = 289 days from June 1, 1845, which will be March 16, 1846.

SECTION L.

CUSTOM-HOUSE BUSINESS.

AMERICAN DUTIES.

6. (p. 205.)		7.
1 2 7 6	(Brought up.)	9 8 6 £.
1 2 8 0	7 9 7 8	4 0
1 1 7 8	9 5 7 tare.	9) 3 9 4 4 0
1 3 7 8	7 0 2 1 net.	\$ 4 3 8 2 . 2 2
1 5 7 0	2 $\frac{1}{2}$	.4 4
1 3 3 8		
8 0 2 0	1 4 0 4 2	1 7 5 2 8 8 8
4 2 draft.	3 5 1 0 5	1 7 5 2 8 8 8
7 9 7 8	\$ 1 7 5 . 5 2 , 5 Ans.	\$ 1 9 2 8 . 1 7 , 6 8 Ans.
(Carried up.)		

8.	9.	10.
1 7 6	2 7 0 tons.	$7890 \times .01\frac{1}{2} = 138.07$
1 4 5	3 0	$7890 - 138 = 7752$
1 2 8	<u>8 1 0 0</u> Ans.	$7752 \times .04 = \$310.08$
1 4 8		[Ans.]
1 5 0		
<hr/>		
7 4 7		11.
2 0 wants.		$450 \times 10 = 4500\text{lb.}$
<hr/>		
7 2 7		40 draft.
1 5 leakage.		<hr/>
<hr/>		4460
7 1 2		<hr/>
.15		357 = 8 per cent.
<hr/>		
3 5 6 0		4103
7 1 2		<hr/>
<hr/>		.04
<hr/>		<hr/>
\\$ 1 0 6.8 0	Ans.	\\$ 164.12 Ans.

SECTION LII.

PROPORTION.

5. (p. 212.) 17lb. : 365lb. :: \$ 1.19 : \$ 25.55 Ans.

CANCELLING.

$$\frac{365 \times 1.19}{17} = \$ 25.55 \text{ Ans.}$$

6. 16A. : 197A. :: \$ 720 : \$ 8865 Ans.

CANCELLING.

$$\frac{197 \times 720}{16} = \$ 8865 \text{ Ans.}$$

7. \$ 8865 : \$ 720 :: 197A. : 16A. Ans.

CANCELLING.

$$\begin{array}{r} 16 \\ \overline{720 \times 197} \\ \underline{8865} \\ 197 \end{array} = 16A. \text{ Ans.}$$

8. 15hhd. : 84hhd. :: \$ 175.95 : \$ 985.32 Ans.

CANCELLING.

$$\begin{array}{r} 11.73 \\ \overline{84 \times 175.95} \\ \underline{15} \\ 1 \end{array} = \$ 985.32 \text{ Ans.}$$

9. 12mo. : 40mo. :: \$ 6 : \$ 20 Ans.

CANCELLING.

$$\begin{array}{r} 20 \\ \overline{40 \times \$} \\ \underline{12} \\ \$ \end{array} = \$ 20 \text{ Ans.}$$

10. 15 men : 10 men :: 45 days : 30 days, Ans.

CANCELLING.

$$\begin{array}{r} 3 \\ \overline{10 \times 45} \\ \underline{15} \\ 1 \end{array} = 30 \text{ days, Ans.}$$

11. $7 + 9 = 16 : 8 + 4 = 12 :: 12 : 9$ Ans.

CANCELLING.

$$\begin{array}{r} 3 \quad 3 \\ \overline{12 \times 12} \\ \underline{16} \\ 4 \end{array} = 9 \text{ Ans.}$$

12. 3 men : 9 men :: 17 days : 51 days, Ans.

CANCELLING.

$$\begin{array}{r} 3 \\ \overline{9 \times 17} \\ \underline{9} \\ 1 \end{array} = 51 \text{ days, Ans.}$$

13. 17 days : 51 days :: 3 men : 9 ; 9 — 3 = 6 men, Ans.
CANCELLING.

$$\begin{array}{r} 3 \\ 51 \times 3 \\ \hline 17 \\ 1 \end{array} = 9 ; 9 - 3 = 6 \text{ men, Ans.}$$

14. $\frac{5}{4}$ rd. : 160rd. :: 1rd. : $29\frac{1}{4}$ rods, Ans.

15. 2bbl. : 24bbl. :: \$ 12 : \$ 144 Ans.

CANCELLING.

$$\begin{array}{r} 12 \\ 24 \times 12 \\ \hline 2 \\ 1 \end{array} = \$ 144 \text{ Ans.}$$

16. 5quin. : 75quin. :: \$ 16.25 : \$ 243.75 Ans.

CANCELLING.

$$\begin{array}{r} 15 \\ 75 \times 16.25 \\ \hline 5 \\ 1 \end{array} = \$ 243.75 \text{ Ans.}$$

17. 2 cords : 17 cords :: \$ 11.50 : \$ 97.75 Ans.

CANCELLING.

$$\begin{array}{r} 575 \\ 17 \times 11.50 \\ \hline 2 \\ 1 \end{array} = \$ 97.75 \text{ Ans.}$$

18. 7cwt. : 49cwt. :: \$ 56.85 : \$ 397.95 Ans.

CANCELLING.

$$\begin{array}{r} 7 \\ 49 \times 56.85 \\ \hline 7 \\ 1 \end{array} = \$ 397.95 \text{ Ans.}$$

19. 5A. : 35A. :: \$ 375.75 : \$ 2630.25 Ans.

CANCELLING.

$$\begin{array}{r} 7 \\ 35 \times 375.75 \\ \hline 5 \\ 1 \end{array} = \$ 2630.25 \text{ Ans.}$$

20. \$ 10.50 : \$ 52.50 :: 7pr. : 35pr. Ans.

CANCELLING.

$$\begin{array}{r} 5 \\ \cancel{5} \cancel{2} \cancel{.5} 0 \times 7 \\ \hline 1 \cancel{0} . \cancel{5} 0 \\ 1 \end{array} = 35 \text{ pairs, Ans.}$$

21. \$ 4.75 : \$ 25.50 :: 19lb. : 102lb. Ans.

CANCELLING.

$$\begin{array}{r} 102 \\ \cancel{2} \cancel{5} 5 0 \times 1 \cancel{9} \\ \hline 4. \cancel{7} 5 \\ 25 \end{array} = 102 \text{lb. Ans.}$$

22. 6h. : 24h. :: 48m. : 192 miles, Ans.

CANCELLING.

$$\begin{array}{r} 4 \\ \cancel{2} \times 48 \\ \hline 6 \\ 1 \end{array} = 192 \text{ miles, Ans.}$$

23. 3 men : 8 men :: 24d. : 64d. Ans.

CANCELLING.

$$\begin{array}{r} 8 \\ 8 \times \cancel{3} 4 \\ \hline 3 \\ 1 \end{array} = 64 \text{ days, Ans.}$$

24. 7oz. : 42oz. :: 17 spoons : 102 spoons, Ans.

CANCELLING.

$$\begin{array}{r} 6 \\ \cancel{4} \cancel{2} \times 17 \\ \hline 7 \\ 1 \end{array} = 102 \text{ spoons, Ans.}$$

25. \$ 100 : \$ 850 :: \$ 6 : \$ 51 Ans.

CANCELLING.

$$\begin{array}{r} 17 \quad 3 \\ \cancel{8} \cancel{5} 0 \times 6 \\ \hline 100 \\ 2 \end{array} = \$ 51 \text{ Ans.}$$

26. $\$6 : \$32 :: \$100 : \$533\frac{1}{3}$ Ans.

CANCELLING.

$$\begin{array}{r} 16 \\ \cancel{32} \times 100 \\ \hline \cancel{6} \end{array} = \$533.33\frac{1}{3} \text{ Ans.}$$

27. 20gal. : 180gal. :: 167lb. : 1503lb. Ans.

CANCELLING.

$$\begin{array}{r} 9 \\ \cancel{180} \times 167 \\ \hline \cancel{20} \end{array} = 1503 \text{lb. Ans.}$$

1

28. 2ft. : 75ft. :: 3ft. : 112 $\frac{1}{2}$ ft. Ans.

29. $\$4.75 : \$160 :: 36 \text{ miles} : 1212\frac{1}{2} \text{ miles}$, Ans.

30. 8 days : 12 days :: 100 men : 150 men, Ans.

CANCELLING.

$$\begin{array}{r} 3 \quad 50 \\ \cancel{12} \times \cancel{100} \\ \hline \cancel{8} \end{array} = 150 \text{ men, Ans.}$$

32.

BY ANALYSIS.

If $\frac{1}{2}$ yd. cost $\frac{3}{5}$ £., 1yd. will cost $\frac{6}{5}$ £., and $\frac{1}{2}$ yd. will cost $\frac{1}{2} \times \frac{6}{5}$ £. = $\frac{3}{5}$ £. = $\frac{3}{5} \times \frac{3}{5}$ £. = $\frac{9}{25}$ £. = 1£. 1s. 0d. Ans.

STATEMENT.

$\frac{1}{2}$ yd. : $\frac{1}{2}$ yd. :: $\frac{3}{5}$ £. = $\frac{1}{2} \times \frac{3}{5}$ £. = $\frac{3}{10}$ £. = 1£. 1s. 0d. Ans.

33.

BY ANALYSIS.

In $13\frac{1}{2}$ yd. are 9 halves; in $13\frac{1}{2}$ yd. are 27 halves. If, therefore, 9 halves cost \$9.75, 1 half will cost $\frac{1}{9}$ of \$9.75 = $\frac{9}{8}$ ¢, and 27 halves will cost 27 times $\frac{9}{8}$ ¢ = $27 \times \frac{9}{8}$ ¢ = \$29.25 Ans.

FORM OF STATEMENT.

$4\frac{1}{2}$ yd. : $13\frac{1}{2}$ yd. :: \$9.75 : \$29.25 Ans.

OPERATION.

$$\frac{1}{2} \times \frac{27}{2} \times \frac{9}{8} = \frac{526.50}{16} = \$29.25 \text{ Ans.}$$

34.

BY ANALYSIS.

If it be 1in. wide, the length must be 144in.; and if it be $2\frac{1}{2}$ in., it will be $144 : 2\frac{1}{2} = 57\frac{3}{5}$ in. Ans.

FORM OF STATEMENT.

$$2\frac{1}{2}\text{in.} : 1\text{in.} :: 144\text{in.} : 57\frac{3}{5}\text{in.} \text{ Ans.}$$

35.

BY ANALYSIS.

If $\frac{1}{16}$ cost 51£., $\frac{1}{16}$ will cost $\frac{1}{16}$; and $\frac{1}{16}$, or the whole ship, will cost 16 times $\frac{1}{16}\text{£.} = \frac{1}{16} \times \frac{1}{16} = \frac{1}{256}\text{£.}$; $\frac{1}{16}$ of $\frac{1}{16}\text{£.} = \frac{1}{16} \times \frac{1}{16}\text{£.} = \frac{1}{256}\text{£.} = \frac{1}{16}\text{d.}$; and $\frac{3}{16}$ will cost 3 times $\frac{1}{16}\text{d.} = \frac{3}{16} \times \frac{1}{16}\text{d.} = \frac{3}{256}\text{d.} = 10\text{d. } 18\text{s. } 6\frac{3}{4}\text{d.} \text{ Ans.}$

FORM OF STATEMENT.

$$\frac{1}{16} : \frac{3}{16} :: 51\text{£.} : 10\text{d. } 18\text{s. } 6\frac{3}{4}\text{d.} \text{ Ans.}$$

OPERATION.

$$\frac{1}{16} \times \frac{3}{16} \times \frac{1}{16} = 10\text{d. } 18\text{s. } 6\frac{3}{4}\text{d.} \text{ Ans.}$$

36.

BY ANALYSIS.

If 5yd. cost \$7, 1yd. cost $\frac{7}{5}$; and if 7yd. sold for \$11, 1yd. sold for $\frac{11}{7}$; therefore $\frac{11}{7} - \frac{7}{5} = \frac{8}{35}$ were gained on each yard. And as \$200 were gained, there must have been $200 : \frac{8}{35} = 1166\frac{2}{7}$ yd.; and $1166\frac{2}{7} : 129\frac{1}{7} = 9$ bales, Ans.

FORM OF STATEMENT.

$$\begin{aligned} 5\text{yd.} : 1\text{yd.} &:: \$7 : \frac{7}{5}; 7\text{yd.} : 1\text{yd.} :: \$11 : \frac{11}{7}; \frac{11}{7} - \frac{7}{5} = \frac{8}{35}; \\ \$\frac{8}{35} &: \$200 :: 1\text{yd.} : 1166\frac{2}{7}\text{yd.}; \\ 129\frac{1}{7}\text{yd.} &: 1166\frac{2}{7}\text{yd.} :: 1 \text{bale} : 9 \text{ bales, Ans.} \end{aligned}$$

37. $13^{\circ} 10' 35'' : 360^{\circ} :: 24\text{h.} : 27\text{da. } 7\text{h. } 43\text{m.} + \text{ Ans}$

38.

BY ANALYSIS.

If 7lb. cost $\frac{3}{4}$, 1lb. will cost $\frac{1}{7} \times \frac{3}{4} = \frac{3}{28}$; and 12lb. will cost $\frac{1}{7} \times \frac{3}{28} = \frac{3}{196} = \$1.28\frac{1}{4}$. Ans.

FORM OF STATEMENT.

$$7\text{lb.} : 12\text{lb.} :: \frac{3}{4} : \$1.28\frac{1}{4} \text{ Ans.}$$

39.

BY ANALYSIS.

If 7lb. cost \$1.75, 1lb. will cost $\frac{175}{7} = \$0.25$; and if 25 cents buy 1lb., \$213.50 will buy as many pounds as this sum contains 25 cents; thus, $\$213.50 \div .25 = 854\text{lb.} = 7\text{cwt. } 2\text{qr. } 14\text{lb.}$ Ans.

FORM OF STATEMENT.

$$\$1.75 : \$213.50 :: 7\text{lb.} : 854\text{lb.} = 7\text{cwt. } 2\text{qr. } 14\text{lb.}$$
 Ans.

40.

BY ANALYSIS.

If 7oz. of gold is worth 30£., 1oz. is worth $\frac{30}{7}\text{£.}$; and $7\text{lb. } 11\text{oz.} = 95\text{oz.}$ is worth $\frac{95}{7} \times \frac{30}{7} = 2850\text{£.} = 407\text{£. } 2\text{s. } 10\text{d.}$ Ans.

FORM OF STATEMENT.

$$7\text{oz.} : 7\text{lb. } 11\text{oz.} :: 30\text{£.} : 407\text{£. } 2\text{s. } 10\text{d.}$$
 Ans.

41.

BY ANALYSIS.

\$500 for 6 months, is the same as \$3000 for 1 month; and if \$3000 give 1 month, \$600 will give $\$3000 \div \$600 = 5$ months, Ans.

FORM OF STATEMENT.

$$\$600 : \$500 :: 6\text{m.} : 5\text{m.}$$
 Ans.

42.

BY ANALYSIS.

If \$8 give 7 oz., \$1 would give 56oz., and $\$7\frac{1}{2}$ would give $56 \div 7\frac{1}{2} = 7\frac{7}{15}\text{oz.}$ Ans.

FORM OF STATEMENT.

$$\$7.50 : \$8.00 :: 7\text{oz.} : 7\frac{7}{15}\text{oz.}$$
 Ans.

43.

BY ANALYSIS.

Each suit would contain $3\frac{1}{4} \times 1\frac{1}{8} = 2\frac{25}{32}$ square yards; and to clothe the regiment, it would require $1000 \times \frac{225}{32} = 22500 = 7031\frac{1}{4}\text{yd.}$ To line this cloth, it would require $7031.25 \div 1.25 = 5625\text{yd.}$ Ans.

FORM OF STATEMENT.

1 man : 1000 men :: $3\frac{3}{4} \times 1\frac{1}{8} = 4\frac{3}{4}$ yd. : $7031\frac{1}{4}$ yd.;
 $1\frac{1}{4}$ yd. : 1 yd. :: $7031\frac{1}{4}$ yd. : 5625 yd. Ans.

44.

BY ANALYSIS.

If $9\frac{1}{2}$ yd. cost \$11 $\frac{1}{2}$, 1yd. will cost $11\frac{1}{2} \div 9\frac{1}{2} = \$1.17\frac{1}{2}$;
 $16\frac{1}{3}$ E. = $20\frac{20}{27}$ yd.; and if 1yd. cost $\$1.17\frac{1}{2}$, $20\frac{20}{27}$ yd.
will cost $20\frac{20}{27} \times 1\frac{1}{17} = \24 Ans.

FORM OF STATEMENT.

$9\frac{1}{2}$ yd. : $16\frac{1}{3}$ E. = $20\frac{20}{27}$ yd. :: $\$11\frac{1}{2}$: \$24 Ans.

45.

BY ANALYSIS.

If for \$17280 there be received \$15120 only, for \$1 there
will be received $17280 \div 15120 = \$0.87\frac{1}{2}$. A will, therefore,
receive $\$5670 \times .87\frac{1}{2} = \4961.25 Ans.

FORM OF STATEMENT.

\$17280 : \$15120 :: \$1 : \$0.87 $\frac{1}{2}$;
\$1 : \$0.87 $\frac{1}{2}$:: \$5670 : \$4961.25 Ans.

46.

BY ANALYSIS.

49 guineas = $49 \times 28 = 1372$ s.; and, if 57yd. cost
1372s., 1yd. will cost $1372 \div 57 = 24\frac{4}{5}$ s.; $\frac{1}{5}$ of which is
 $6\frac{1}{5}$ s. = price of 1qr. An ell English will cost 5 times as
much; $6\frac{1}{5} \times 5 = 30\frac{4}{5}$ s. = 1£. 10s. $1\frac{1}{5}$ d. Ans.

FORM OF STATEMENT.

57yd. : 1EE. :: 49guin. : 1£. 10s. $1\frac{1}{5}$ d. Ans.

47.

BY ANALYSIS.

If \$1.15 buy 1gal., \$100 will buy $100 \div 1.15 = 86$ gal.
3qt. $1\frac{1}{2}$ pt. Ans.

FORM OF STATEMENT.

\$1.15 : \$100 :: 1gal. : 86gal. 3qt. $1\frac{1}{2}$ pt. Ans.

48.

BY ANALYSIS.

If 9 packages cost \$34560, 1 package will cost $\$34560 \div 9 = \3840 ; and if 1 parcel cost $\$3840 \div 8 = \480 , 1 piece will cost $\$480 \div 12 = \40 , and 1 yd. will cost $\$40 \div 20 = \2.00 Ans.

FORM OF STATEMENT.

9pack. : 1pack. :: \$34560 : \$3840;
 Spar. : 1par. :: \$3840 : \$480; 12pieces : 1piece :: \$480 : \$40;
 20yd. : 1yd. :: \$50 : \$2.00 Ans.

49.

BY ANALYSIS.

If 75 gallons run into the cistern, and 40 gallons run out per hour, there is left in the cistern 35 gallons; and if 35 gallons give 1 hour, 500 gallons will give $500 \div 35 = 14\text{h. } 17\text{m. } 8\frac{4}{5}\text{sec.}$ Ans.

FORM OF STATEMENT.

75gal. — 40gal. = 35gal.;
 35gal. : 500gal. :: 1h. : 14h. 17m. $8\frac{4}{5}\text{sec.}$ Ans.

50.

BY ANALYSIS.

If one pair may be bought for \$0.56, then for \$120.96 may be had $120.96 \div 56 = 216$ pair = 18doz. Ans.

FORM OF STATEMENT.

\$0.56 : \$120.96 :: 1 pair : 216 pair = 18doz. Ans.

51.

BY ANALYSIS.

If the first pipe will empty the cistern in 20 minutes, in 1 minute $\frac{1}{20}$ of it will be emptied. The second pipe will empty $\frac{1}{15}$ of it in 1 minute. The third pipe will empty $\frac{1}{75}$ of it in a minute. Therefore in 1 minute $\frac{1}{20} + \frac{1}{15} + \frac{1}{75} = \frac{13}{100}$ of the cistern will be emptied. And, if $\frac{13}{100}$ of the cistern be emptied in 1 minute, the whole will be emptied in $600 - 53 = 11\text{h. } 19\frac{4}{5}\text{m.}$ Ans.

FORM OF STATEMENT.

$$20\text{m.} : 1\text{m.} :: 1\text{cist.} : \frac{1}{20}$$

$$40\text{m.} : 1\text{m.} :: 1\text{cist.} : \frac{1}{40}$$

$$75\text{m.} : 1\text{m.} :: 1\text{cist.} : \underline{\frac{1}{75}}$$

 $\frac{1}{60}$

$$\frac{1}{60}\text{cist.} : 1\text{cist.} :: 1\text{m.} : 11\text{m. } 19\frac{1}{3}\text{sec. Ans.}$$

52.

BY ANALYSIS.

If A can mow the field in 5 days, in 1 day he will mow $\frac{1}{5}$ of it. B in 1 day will mow $\frac{1}{3}$ of the field. Therefore A and B will, in one day, mow $\frac{1}{5} + \frac{1}{3} = \frac{8}{15}$ of the field; and it will require $30 \div \frac{8}{15} = 2\frac{8}{11}$ days to mow the whole field, Ans.

FORM OF STATEMENT.

$$5\text{da.} : 1\text{da.} :: 1 \text{ field} : \frac{1}{5}; 6\text{da.} : 1\text{da.} :: 1 \text{ field} : \frac{1}{6}$$

$$\frac{1}{5} + \frac{1}{6} = \frac{11}{30} \text{ field} : 1 \text{ field} :: 1 \text{ da.} : 2\frac{8}{11}\text{da. Ans.}$$

53.

BY ANALYSIS.

To raise the wall 8 feet, it required the labor of 6 men 12 days; that is, the labor of 72 men 1 day; and to raise it 1 foot, it would take $\frac{1}{8}$ of 72 men $= 72 \div 8 = 9$ men; and to raise it the remaining $32 - 8 = 24$ feet in one day, it must require 24 times 9 men; $24 \times 9 = 216$ men. But as they have 6 days to perform the labor, it will take only $\frac{1}{6}$ of their number, $216 \div 6 = 36$ men. Ans.

FORM OF STATEMENT.

$$8 \text{ feet} : 24 \text{ feet} :: 6 \text{ men} : 18 \text{ men.}$$

$$\text{Then } 6 \text{ days} : 12 \text{ days} :: 18 \text{ men} : 36 \text{ men, Ans.}$$

54.

BY ANALYSIS.

A can do $\frac{1}{20}$ of the labor in 1 day, and A and C can do $\frac{1}{7}$ of it; therefore C alone can do only $\frac{1}{7} - \frac{1}{20} = \frac{1}{35}$ of

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it. It will therefore take him 30 days to build the boat alone, Ans.

FORM OF STATEMENT.

$$\frac{1}{2} - \frac{1}{20} = \frac{1}{10} : 1 :: 1 \text{ day} : 30 \text{ days, Ans.}$$

55.

BY ANALYSIS.

If 700 men are provided with 184000lb., there are for each man $184000 \div 700 = 262\frac{1}{2}$ lb. And if each person consume 5lb. per week, he will have sufficient to last him $262\frac{1}{2} \div 5 = 52\frac{1}{2}$ weeks = 52 weeks 4 days, Ans.

FORM OF STATEMENT.

$$700 \text{ men} : 1 \text{ man} :: 184000 \text{ lb.} : 262\frac{1}{2} \text{ lb.}$$

Then 5lb. : $262\frac{1}{2}$ lb. :: 1 week : 52 weeks 4 days, Ans.

56.

BY ANALYSIS.

Each man has $3 \times \frac{3}{4} = \frac{9}{4}$ lb. of beef per week, and 25 men have $25 \times \frac{9}{4} = 56\frac{1}{4}$ lb. If, then, $56\frac{1}{4}$ lb. last 1 week, 3150lb. will last $3150 \div 56\frac{1}{4} = 56$ weeks, Ans.

FORM OF STATEMENT.

$$\frac{9}{4} \times 3 \times 25 = 56\frac{1}{4} \text{ lb.} : 3150 \text{ lb.} :: 1 \text{ week} : 56 \text{ weeks, Ans.}$$

57.

BY ANALYSIS.

The floor contains $20 \times 16 = 320$ square feet; and $320 \times 144 = 46080$ square inches. The tiles contain $8 \times 8 = 64$ square inches each; and it will therefore require $46080 \div 64 = 720$ tiles, Ans.

FORM OF STATEMENT.

$$8 \times 8 = 64 \text{ in.} : 20 \times 16 \times 144 = 46080 \text{ in.} :: 1 \text{ tile} : 720 \text{ tiles, Ans.}$$

58.

FORM OF STATEMENT.

$10 \times 9 \times 4 = 360$ cubic inches in each stone.

$80 \times 20 \times 2\frac{1}{4} \times 1728 = 6220800$ cubic inches in the wall.

$360 \text{ in.} : 6220800 \text{ in.} :: 1 \text{ stone} : 17280 \text{ stones, Ans.}$

59.

FORM OF STATEMENT.

$$\$3.00 \times 60 = \$180, \text{ price given for the Holland.}$$

$$\$4.00 \times 60 = \$240, \text{ price obtained for it.}$$

$$\$180 : \$240 :: \$240 : \$320 \text{ Ans.}$$

60.

BY ANALYSIS.

$$27 \times 7 = 189 = \text{miles A is ahead of B.}$$

$36 - 27 = 9$ miles that B gains each day on A. If, therefore, 9 miles are gained in one day, it will require, to gain 189 miles, $189 \div 9 = 21$ days, Ans.

FORM OF STATEMENT.

$$36 - 27 = 9 \text{m.} : 189 \text{m.} :: 1 \text{ day} : 21 \text{ days, Ans.}$$

61.

BY ANALYSIS.

2s. 3d. = 27d., price obtained for the coffee. It is evident that 27d. is $\frac{1}{8}$ of the cost; therefore $\frac{1}{8} \times 27 \text{d.} = 20 \text{d.}$ was the cost, Ans.

FORM OF STATEMENT.

$$135 \text{d.} : 100 \text{d.} :: 27 \text{d.} : 20 \text{d. Ans.}$$

62.

FORM OF STATEMENT.

$2000 \times 12 \times 7 \times 14 = 2352000 \div 16 = 147000 \text{lb. whole quantity.}$

$$105 \times 200 = 21000 \text{lb. wholly spoiled.}$$

$$147000 - 21000 = 126000 \text{lb. left to subsist on.}$$

$$2000 \times 12 \times 7 = 168000 \text{ rations.}$$

$$2016000 \div 168000 = 12 \text{oz. for each man per day, Ans.}$$

63.

FORM OF STATEMENT.

$2000 \times 12 \times 7 \times 12 = 2016000 \div 16 = 126000 \text{lb. quantity subsisted on.}$

$$126000 \div 6 = 21000 \text{lb. spoiled.}$$

$$21000 \times 7 = 147000 \text{lb. the whole quantity, Ans.}$$

64. FORM OF STATEMENT.

$$2000 \times 12 \times 7 \times 14 = 2352000 \div 16 = 147000 \text{lb. whole weight.}$$

$$2000 \times 12 \times 7 \times 12 = 2016000 \div 16 = 126000 \text{lb. left to subsist on, Ans.}$$

65. FORM OF STATEMENT.

$$2000 \times 12 \times 7 \times 12 = 2016000 \div 16 = 126000 \text{lb.}$$

$$126000 \div 6 = 21000 = \text{quantity lost.}$$

$$21000 \times 7 = 147000 \text{lb. whole quantity.}$$

$$147000 \times 16 = 2352000 \div 2000 \times 12 \times 7 = 14 \text{oz. Ans.}$$

66. FORM OF STATEMENT.

$$.85 \text{gal.} : .25 \text{gal.} :: \$2.72 : \$0.80 \text{ Ans.}$$

67. FORM OF STATEMENT.

$$61.3 \text{lb.} : 1 \text{lb.} :: \$44.9942 : \$0.734 \text{ Ans.}$$

68. FORM OF STATEMENT.

$$.15 \text{hhd.} : 1 \text{hhd.} :: \$2.39 : \$0.3585 \text{ Ans.}$$

69. FORM OF STATEMENT.

$$.75 \text{ ton} : 1 \text{ ton} :: \$15 : \$20.00 \text{ Ans.}$$

70. FORM OF STATEMENT.

$$.5 \text{yd.} : 6 \text{yd.} :: 10 \text{yd.} : 120 \text{yd. Ans.}$$

71. FORM OF STATEMENT.

$$10 \text{h.} : 12 \text{h.} :: 15 \text{ days} : 18 \text{ days, Ans.}$$

72. FORM OF STATEMENT.

$$9 \text{m.} : 5 \text{m.} :: 450 \text{ men} : 250 \text{ men} ; 450 - 250 = 200 \text{ men, Ans.}$$

73. BY ANALYSIS.

As the hour hand and minute hand pass each other 11 times in 12 hours, and as they are together at 12 o'clock,

it is evident that they will next pass each other in $\frac{1}{11}$ of 12 hours = 1h. 5m. $27\frac{3}{11}$ sec. Ans.

FORM OF STATEMENT.

$$11\text{h.} : 12\text{h.} :: 1\text{h.} : 1\text{h. } 5\text{m. } 27\frac{3}{11}\text{sec. Ans.}$$

74.

BY ANALYSIS.

If A and B can perform a piece of labor in $5\frac{5}{11}$ days, it is evident, that in 1 day they would do $\frac{1}{5\frac{5}{11}} = \frac{1}{6\frac{1}{11}}$ of the work.

If B and C can do the work in $6\frac{3}{4}$ days, in 1 day they would perform $\frac{1}{6\frac{3}{4}} = \frac{1}{20}$ of the work. If A and C can do the work in 6 days, in 1 day they would perform $\frac{1}{6}$ of it. It then appears, that A, B, and C, by laboring each 2 days, will perform $\frac{1}{6} + \frac{1}{20} + \frac{1}{6} = \frac{1}{5} + \frac{1}{20} = \frac{1}{4}$ of the work; and, therefore, by laboring 1 day each, they would do $\frac{1}{2}$ of $\frac{1}{4} = \frac{1}{8}$ of it. And if $\frac{1}{8}$ of the labor be performed in 1 day, it is evident that the whole work will be performed in 4 days, Ans.

If A, B, and C, can do $\frac{1}{8}$ of the work in one day, and A and B can do $\frac{1}{6}$, it is evident that C can do $\frac{1}{8} - \frac{1}{6} = \frac{1}{24}$ = $\frac{1}{15}$ of it in 1 day, and therefore will be 15 days in performing the whole. B and C can do $\frac{1}{20}$ of it in a day; therefore A can do $\frac{1}{8} - \frac{1}{20} = \frac{1}{10}$ of it in a day, or he will be 10 days in doing the whole. A and C can do $\frac{1}{8}$ of the work in a day; therefore B can do $\frac{1}{8} - \frac{1}{8} = \frac{1}{12}$ in a day, or, in performing the whole labor, he will be 12 days, Ans.

FORM OF STATEMENT.

$$5\frac{5}{11}\text{ days} : 1\text{ day} :: 1\text{ work} : \frac{1}{6\frac{1}{11}}\text{ work} = A \text{ and } B.$$

$$6\frac{3}{4}\text{ days} : 1\text{ day} :: 1\text{ work} : \frac{1}{20}\text{ work} = B \text{ and } C.$$

$$6\text{ days} : 1\text{ day} :: 1\text{ work} : \frac{1}{8}\text{ work} = A \text{ and } C.$$

$$\begin{aligned} \frac{1}{8}\text{ work} &= 2A, 2B, 2C = \\ \frac{1}{8}\text{ work} &= A, B, \text{ and } C. \end{aligned}$$

$$\frac{1}{4} - \frac{1}{15} = \frac{1}{15} \text{ work : } 1 \text{ work} :: 1 \text{ day} : 15 \text{ days} = C.$$

$$\frac{1}{4} - \frac{3}{10} = \frac{1}{10} \text{ work : } 1 \text{ work} :: 1 \text{ day} : 10 \text{ days} = A.$$

$$\frac{1}{4} - \frac{1}{6} = \frac{1}{12} \text{ work : } 1 \text{ work} :: 1 \text{ day} : 12 \text{ days} = B.$$

$$\frac{1}{4} \text{ work : } 1 \text{ work} :: 1 \text{ day} : 4 \text{ days} = A, B, \text{ and } C.$$

75. If A, B, and C can do the work in 4 days, they would do $\frac{1}{4}$ of it in one day. If B can do it in 12 days, he would do $\frac{1}{12}$ of it in one day. If C can do the work in 15 days, he would do $\frac{1}{15}$ of it in one day. And if B can do $\frac{1}{12}$ of it, and C $\frac{1}{15}$ of it, it is evident that they both would do $\frac{1}{12} + \frac{1}{15} = \frac{3}{20}$ of it, in a day. And if B and C do $\frac{3}{20}$, and A, B, and C do $\frac{1}{4}$, in a day, it is evident that A would do $\frac{1}{4} - \frac{3}{20} = \frac{1}{10}$ of it. If A does $\frac{1}{10}$ of it and B $\frac{1}{12}$ of it in a day, they would both do $\frac{1}{10} + \frac{1}{12} = \frac{11}{60}$ of it in a day. And if $\frac{11}{60}$ of the work be done in one day, it is evident that it will take them as many days to complete the work as 11 is contained in 60. $60 \div 11 = 5\frac{5}{11}$ days, Ans.

76. As one brick contains $2 \times 4 \times 8 = 64$ cubic inches, it is evident that it will take $1728 \div 64 = 27$ bricks for every cubic foot in the walls of the house. $46 + 28 = 74$; $74 \times 2 = 148$, distance round the house. From this sum we deduct $4 \times 1\frac{1}{4} = 6$ feet, for the corners. $148 - 6 = 142$; $142 \times 25 = 3550$; $3550 \times 1\frac{1}{2} = 5325$ cubic feet in the walls. $5325 \times 27 = 143,775$ bricks, Ans.

77. \$150 : \$200 :: 12mo. : 16mo. Ans.

78. 7 cows : 3 cows :: 5 oxen : $2\frac{1}{4}$ oxen; $2 + 2\frac{1}{4} = 4\frac{1}{4}$ oxen : 5 oxen :: 87 days : 105 days, Ans.

79. 8mo. : 6 — 4 = 2mo. :: 360 men : 90 men; $360 - 90 = 270$ men, Ans.

80. $10\frac{1}{4} = 10.25$; $1\frac{1}{4} = 1.875$; $100 - 5 = 95$; $100 : 95 :: 1.875 \text{yd.} : 1.78125 \text{yd.}$; $100 : 95 :: 1.78125 \text{yd.} : 1.6921875 \text{yd.}$; $1.6921875 : 1 :: 10.25 \text{yd.} : 6\frac{8}{15} \text{yd.}$ Ans.

SECTION LIII.
COMPOUND PROPORTION.

4. (p. 221.)

$$\begin{array}{r} \$100 : \$500 \\ 12\text{mo.} : 4\text{mo.} \end{array} \} :: \$6 : \$10 \text{ Ans.}$$

CANCELLING.

$$\begin{array}{r} 5 \quad 2 \\ \cancel{500} \times \cancel{4} \times \cancel{6} \\ \hline 100 \times 12 \\ 1 \quad 6 \end{array} = \$10 \text{ Ans.}$$

5.

$$\begin{array}{r} \$6 : \$10 \\ 4\text{mo.} : 12\text{mo.} \end{array} \} :: \$100 : \$500 \text{ Ans.}$$

CANCELLING.

$$\begin{array}{r} 2 \quad 25 \\ 10 \times \cancel{12} \times \cancel{100} \\ \hline 6 \times 4 \\ 1 \quad 1 \end{array} = \$500 \text{ Ans.}$$

6.

$$\begin{array}{r} \$500 : \$100 \\ \$6 : \$10 \end{array} \} :: 12\text{mo.} : 4\text{mo.} \text{ Ans.}$$

CANCELLING.

$$\begin{array}{r} 2 \quad 2 \\ 100 \times \cancel{12} \times \cancel{10} \\ \hline 500 \times 6 \\ 1 \end{array} = 4 \text{ months, Ans.}$$

7.

$$\begin{array}{r} \$500 : \$100 \\ 4\text{mo.} : 12\text{mo.} \end{array} \} :: \$10 : \$6 \text{ Ans.}$$

CANCELLING.

$$\begin{array}{r} 2 \quad 3 \\ 100 \times \cancel{12} \times \cancel{10} \\ \hline 500 \times 4 \\ 1 \end{array} = \$6 \text{ Ans.}$$

$$\begin{array}{rcl} 8 \\ 8 \text{ men} : 24 \text{ men} \\ 13 \text{ weeks} : 52 \text{ weeks} \end{array} \left. \begin{array}{l} 8 \\ \hline \end{array} \right\} :: \$32 : \$384 \text{ Ans.}$$

CANCELLING.

$$\begin{array}{r} 3 \quad 4 \\ 24 \times 52 \times 32 \\ \hline 8 \times 13 \\ 1 \quad 1 \end{array} = \$384 \text{ Ans.}$$

$$\begin{array}{rcl} 60 \text{ men} & : & 12 \text{ men} \\ 30 \text{ feet} & : & 300 \text{ feet} \\ 6 \text{ feet} & : & 8 \text{ feet} \\ 3 \text{ feet} & : & 6 \text{ feet} \\ 8 \text{ hours} & : & 12 \text{ hours} \end{array} \left. \begin{array}{l} 9. \\ \hline \end{array} \right\} :: 15 \text{ days} : 120 \text{ days, Ans.}$$

CANCELLING.

$$\begin{array}{r} 10 \quad 1 \\ 12 \times 300 \times 8 \times 6 \times 12 \times 15 \\ \hline 60 \times 30 \times 6 \times 5 \times 5 \\ 4 \quad 1 \quad 1 \end{array} = 120 \text{ days, Ans.}$$

$$\begin{array}{rcl} 16 \text{ horses} & : & 32 \text{ horses} \\ 24 \text{ days} & : & 48 \text{ days} \end{array} \left. \begin{array}{l} 10. \\ \hline \end{array} \right\} :: 84 \text{ bushels} : 336 \text{ bushels, Ans.}$$

CANCELLING.

$$\begin{array}{r} 2 \quad 2 \\ 32 \times 48 \times 84 \\ \hline 16 \times 24 \\ 1 \quad 1 \end{array} = 336 \text{ bushels, Ans.}$$

$$\begin{array}{rcl} 644 \text{ lb.} & : & 865 \text{ lb.} \\ 150 \text{ miles} & : & 64 \text{ miles} \end{array} \left. \begin{array}{l} 11. \\ \hline \end{array} \right\} :: \$24.58 : \$14.08,6+ \text{ Ans.}$$

CANCELLING.

$$\begin{array}{r} 173 \quad 16 \\ 865 \times 64 \times 24.58 \\ \hline 644 \times 150 \\ 161 \quad 30 \end{array} = \$14.08,6+ \text{ Ans.}$$

$$\begin{array}{l} 7\frac{1}{4}\text{oz.} = 7.25; 4\text{s. 2d.} = 50\text{d.}; 5\text{s. 6d.} = 66\text{d.}; 1\text{s. 2d.} = 14\text{d.} \\ 66\text{d.} : 50\text{d.} \left. \begin{array}{l} \\ \end{array} \right\} : : 7.25\text{oz.} : 16\frac{1}{2}\text{oz. Ans.} \\ 4\frac{1}{4}\text{d.} : 14\text{d.} \left. \begin{array}{l} \\ \end{array} \right\} \end{array}$$

CANCELLING.

$$\begin{array}{r} 2 \quad 7 \\ \cancel{5} \cancel{0} \times \cancel{1} \cancel{4} \times 7.25 \\ \hline 66 \times 4.75 \\ 33 \quad 19 \end{array} = 16\frac{1}{2}\text{oz. Ans.}$$

$$\begin{array}{l} 24 \text{ men} : 496 \text{ men} \\ 9 \text{ hours} : 11 \text{ hours} \\ 7 \text{ hard.} : 4 \text{ hard.} \\ 465 \text{ feet} : 337\frac{1}{2} \text{ feet} \\ 3\frac{3}{4} \text{ feet} : 5\frac{1}{2} \text{ feet} \\ 2\frac{1}{2} \text{ feet} : 3\frac{1}{2} \text{ feet} \end{array} \left. \begin{array}{l} \\ \\ \\ \\ \end{array} \right\} : : 5\frac{1}{2} \text{ days} : 132 \text{ days, Ans.}$$

SECTION LIV.

CHAIN RULE.

2. (p. 222.)

FORM OF STATEMENT.

$$\begin{array}{ll} 12\text{lb. Boston} & = 10\text{lb. Amsterdam;} \\ 10\text{lb. Amsterdam} & = 12\text{lb. Paris;} \\ 80\text{lb. Paris.} & \end{array}$$

OPERATION.

$$\begin{array}{r} 12 \times 10 \times 80 = 9600 \\ \hline 10 \times 12 = 120 \end{array} = 80\text{lb. Ans.}$$

3.

FORM OF STATEMENT.

$$\begin{array}{ll} 25\text{lb. Boston} & = 22\text{lb. Nuremburg;} \\ 88\text{lb. Nuremburg} & = 92\text{lb. Hamburg;} \\ 46\text{lb. Hamburg} & = 49\text{lb. Lyons;} \\ 98\text{lb. Lyons.} & \end{array}$$

OPERATION.

$$\frac{25 \times 88 \times 46 \times 98 = 9917600}{22 \times 92 \times 49 = 99176} = 100\text{lb. Ans.}$$

4.

FORM OF STATEMENT.

- 24s. Massachusetts = 32s. New York ;
 48s. New York = 45s. Pennsylvania ;
 15s. Pennsylvania = 10s. Canada ;
 100s. Massachusetts.

OPERATION.

$$\frac{32 \times 45 \times 10 \times 100 = 1440000}{24 \times 48 \times 15 = 1728} = 83\frac{1}{3}\text{s. Ans.}$$

5.

FORM OF STATEMENT.

- 17 men = 25 women ;
 5 women = 7 boys ;
 75 boys.

OPERATION.

$$\frac{17 \times 5 \times 75 = 6375}{25 \times 7 = 175} = 36\frac{1}{3}\text{ men, Ans.}$$

6.

FORM OF STATEMENT.

- 10bbl. apples = 5 cords wood ;
 20 cords wood = 4 tons hay ;
 50 tons hay.

OPERATION.

$$\frac{10 \times 20 \times 50 = 10000}{5 \times 4 = 20} = 500\text{bbl. Ans.}$$

7.

FORM OF STATEMENT.

100A. Bradford = 120A. Haverhill ;
 50A. Haverhill = 65A. Methuen ;
 150A. Methuen.

OPERATION.

$$100 \times 50 \times 150 = \frac{750000}{120 \times 65} = 96\frac{2}{3}\text{A. Ans.}$$

8.

FORM OF STATEMENT.

10lb. cheese = 7lb. butter ;
 11lb. butter = 2bu. corn ;
 11bu. corn = 8bu. rye ;
 4bu. rye = 1 cord wood ;
 10 cords wood.

OPERATION.

$$10 \times 11 \times 11 \times 4 \times 10 = \frac{48400}{7 \times 2 \times 8 \times 1} = 432\frac{1}{2}\text{lb. Ans.}$$

SECTION LV.

PARTNERSHIP, OR COMPANY BUSINESS.

(p. 224.)

2.

BY ANALYSIS.

The capital is \$ 1100. A's stock is \$ 250; his share of the loss will therefore be $\frac{250}{1100} = \frac{1}{44}$. B's stock is \$ 300;

his share of the loss therefore is $\frac{3}{1100} = \frac{3}{11}$. C's stock is \$550, and his share of the loss therefore is $\frac{550}{1100} = \frac{1}{2}$. The loss, being 5 per cent. of the stock, is $\$1100 \times .05 = \55.00 . A's loss will therefore be $\frac{3}{11}$ of \$55 = \$12.50; B's loss $\frac{3}{11}$ of \$55 = \$15.00 and C's loss $\frac{1}{2}$ of \$55 = \$27.50 Ans.

FORM OF STATEMENT.

$$\$1100 \times .05 = \$55.00 = \text{loss.}$$

$$\begin{aligned} \$1100 : \$55.00 &:: \$250 : \$12.50 \text{ A's loss,} \\ \$1100 : \$55.00 &:: \$300 : \$15.00 \text{ B's loss,} \\ \$1100 : \$55.00 &:: \$550 : \$27.50 \text{ C's loss,} \end{aligned} \quad \left. \begin{array}{l} \text{Ans.} \\ \text{Ans.} \end{array} \right\}$$

3.

BY ANALYSIS.

The capital is \$18780. C's stock being \$6780, his share of the gain will be $\frac{6780}{18780} = \frac{11}{33}$ of \$1000 = \$361.02. D's stock is \$12000; his share of the gain will therefore be $\frac{12000}{18780} = \frac{11}{33}$ of \$1000 = \$638.97.71 Ans.

FORM OF STATEMENT.

$$\begin{aligned} \$18780 : \$1000 &:: \$6780 : \$361.02 \text{ C's gain,} \\ \$18780 : \$1000 &:: \$12000 : \$638.97.71 \text{ D's gain,} \end{aligned} \quad \left. \begin{array}{l} \text{Ans.} \\ \text{Ans.} \end{array} \right\}$$

4.

BY ANALYSIS.

M's stock is \$3000, and his share of the gain will be $\frac{3000}{10000} = \frac{3}{10}$ of \$500 = \$150. P's stock is \$2000; his share of the gain will therefore be $\frac{2000}{10000} = \frac{1}{5}$ of \$500 = \$100. Q's stock is \$5000; his share of the gain, then, will be $\frac{5000}{10000} = \frac{1}{2}$ of \$500 = \$250 Ans.

FORM OF STATEMENT.

$$\begin{aligned} \$10000 : \$500 &:: \$3000 : \$150 \text{ M's gain,} \\ \$10000 : \$500 &:: \$2000 : \$100 \text{ P's gain,} \\ \$10000 : \$500 &:: \$5000 : \$250 \text{ Q's gain,} \end{aligned} \quad \left. \begin{array}{l} \text{Ans.} \\ \text{Ans.} \end{array} \right\}$$

5.

BY ANALYSIS.

The whole gain is \$332.50; but C's gain is \$120; A and B's gain, therefore, is \$332.50 - \$120 = \$212.50. A's stock being \$500, his share of the gain will be $\frac{5}{10}$ of $\frac{1}{7}$ of \$212.50 = \$125. B's stock being \$350, his share of the gain will be $\frac{3}{10}$ of $\frac{1}{7}$ of \$212.50 = \$87.50. As the stock of each person in the firm bears the same proportion to his gain as the other; and as A's gain is \$125, and his stock \$500; therefore,

\$125 A's gain : \$500 A's stock :: \$120 C's gain : \$480 C's stock.
Then $\$480 \div 320 = \1.50 , value of C's cloth per yard, Ans.

FORM OF STATEMENT.

$$\begin{aligned} \$850 : \$212.50 &:: \$500 : \$125 \text{ A's gain, } \\ \$850 : \$212.50 &:: \$350 : \$87.50 \text{ B's gain, } \\ \$125 : \$500 &:: \$120 : \$480 \text{ value of C's stock.} \end{aligned} \quad \left. \begin{array}{l} \\ \\ \end{array} \right\} \text{Ans.}$$

$$\$480 \div 320 = \$1.50 \text{ C's cloth per yard, Ans.}$$

6.

BY ANALYSIS.

$$\$5000 + \$6500 + \$7500 = \$19000 \text{ amount of stock.}$$

$$\$19000 \times .40 = \$7600 \text{ gross gain.}$$

$$\$7600 \times .90 = \$6840 \text{ net gain.}$$

$$\begin{aligned} \frac{5000}{19000} = \frac{1}{19} \text{ of } \$6840 &= \$1800 \text{ A's gain,} \\ \frac{6500}{19000} = \frac{1}{19} \text{ of } \$6840 &= \$2340 \text{ B's gain, } \\ \frac{7500}{19000} = \frac{1}{19} \text{ of } \$6840 &= \$2700 \text{ C's gain,} \end{aligned} \quad \left. \begin{array}{l} \\ \\ \end{array} \right\} \text{Ans.}$$

FORM OF STATEMENT.

$$\begin{aligned} \$19000 : \$6840 &:: \$5000 : \$1800 \text{ A's gain, } \\ \$19000 : \$6840 &:: \$6500 : \$2340 \text{ B's gain, } \\ \$19000 : \$6840 &:: \$7500 : \$2700 \text{ C's gain, } \end{aligned} \quad \left. \begin{array}{l} \\ \\ \end{array} \right\} \text{Ans.}$$

7.

BY ANALYSIS.

Amount of debts, \$600 + \$760 + \$840 + \$800 = \$3000.
For every dollar, then, each creditor will receive $\frac{1}{12}$ = $\frac{8}{120}$.

- A will receive $\frac{9}{12}$ of \$600 = \$455.00,
 B will receive $\frac{9}{12}$ of \$760 = \$576.33 $\frac{1}{3}$, } Ans.
 C will receive $\frac{9}{12}$ of \$840 = \$637.00, }
 D will receive $\frac{9}{12}$ of \$800 = \$606.66 $\frac{2}{3}$,

FORM OF STATEMENT.

$$\begin{array}{l} \$3000 : \$2275 :: \$600 : \$455.00 \text{ A receives,} \\ \$3000 : \$2275 :: \$760 : \$576.33\frac{1}{3} \text{ B receives,} \\ \$3000 : \$2275 :: \$840 : \$637.00 \text{ C receives,} \\ \$3000 : \$2275 :: \$800 : \$606.66\frac{2}{3} \text{ D receives,} \end{array} \left. \begin{array}{l} \\ \\ \\ \end{array} \right\} \text{Ans.}$$

8.

BY ANALYSIS.

As the bankrupt owes \$5000, and his effects are only \$4000, he will pay on each dollar $\frac{\$5000}{\$4000} = \frac{5}{4} = \$0.80$ Ans.

FORM OF STATEMENT.

$$\$5000 : \$4000 :: \$1.00 : \$0.80 \text{ Ans.}$$

9.

BY ANALYSIS.

As \$1728 is $\frac{15}{16}$ of the sum owed, that sum must be $\frac{16}{15}$ of \$1728 = \$11520 Ans.

FORM OF STATEMENT.

$$\$0.15 : \$100 :: \$1728 : \$11520 \text{ Ans.}$$

SECTION LVI.

PARTNERSHIP ON TIME.

(p. 226.)

2.

BY ANALYSIS.

\$3200 for 12 months, is the same as \$38400 for 1 month; and \$4200 for 8 months, is the same as \$33600 for 1 month. Therefore the whole stock may be considered \$38400 + \$33600 = \$72000. A's share of the profit will therefore be $\frac{1}{12}$ of \$240 = \$128; B's share will be $\frac{8}{12}$ of \$240 = $\frac{4}{3}$ of \$128 = \$112 Ans.

FORM OF STATEMENT.

$$\begin{array}{r} \$3200 \times 12 = \$38400 \text{ A's product.} \\ \$4200 \times 8 = \$33600 \text{ B's product.} \end{array}$$

\$72000

$$\begin{array}{l} \$72000 : \$240 :: \$38400 : \$128 \text{ A's gain, } \\ \$72000 : \$240 :: \$33600 : \$112 \text{ B's gain, } \end{array} \left. \begin{array}{l} \} \text{Ans.} \\ \} \text{Ans.} \end{array} \right\}$$

BY ANALYSIS.

3. \$300 for 5 months, is the same as \$1500 for 1 month; \$400 for 8 months, is the same as \$3200 for 1 month; \$500 for 3 months, is the same as \$1500 for 1 month. The capital, then, may be considered \$1500 + \$3200 + \$1500 = \$6200. A's share of the gain will therefore be $\frac{5}{12}$ of \$100 = \$24.19 $\frac{1}{2}$; B's share, $\frac{8}{12}$ of \$100 = \$51.61 $\frac{3}{4}$; C's share, $\frac{3}{12}$ of \$100 = \$24.19 $\frac{1}{2}$ Ans.

FORM OF STATEMENT.

$$\$300 \times 5 = \$1500$$

$$\$400 \times 8 = \$3200$$

$$\$500 \times 3 = \$1500$$

$$\underline{\quad\$6200\quad}$$

$$\begin{array}{l} \$6200 : \$100 :: \$1500 : \$24.19\frac{1}{3} \\ \$6200 : \$100 :: \$3200 : \$51.61\frac{3}{4} \\ \$6200 : \$100 :: \$1500 : \$24.19\frac{1}{3} \end{array} \left. \begin{array}{l} A's \text{ gain, } \\ B's \text{ gain, } \\ C's \text{ gain, } \end{array} \right\} \text{Ans.}$$

4. 24 oxen for 8 weeks, is 1 ox for 192 weeks; 18 oxen for 12 weeks, is 216 oxen for 1 week; and 12 oxen for 10 weeks, is 1 ox for 120 weeks. The amount of pasturing is $192 + 216 + 120 = 528$ weeks. A's share is $\frac{1}{24} = \frac{1}{1}$ of $\$26.40 = \9.60 ; B's share is $\frac{1}{18} = \frac{1}{2}$ of $\$26.40 = \10.80 ; C's share is $\frac{1}{12} = \frac{1}{22}$ of $\$26.40 = \6.00 Ans.

FORM OF STATEMENT.

$$24 \text{ oxen} \times 8 = 192 \text{ oxen};$$

$$18 \text{ oxen} \times 12 = 216 \text{ oxen};$$

$$12 \text{ oxen} \times 10 = 120 \text{ oxen};$$

$$\underline{\quad 528 \text{ oxen.}}$$

$$\begin{array}{l} 528 : \$26.40 :: 192 : \$9.60 \text{ what A pays,} \\ 528 : \$26.40 :: 216 : \$10.80 \text{ what B pays,} \\ 528 : \$26.40 :: 120 : \$6.00 \text{ what C pays,} \end{array} \left. \begin{array}{l} \\ \\ \end{array} \right\} \text{Ans.}$$

5. The "stock in trade" is a carriage to ride 144 miles; and the expense for the carriage, \$25, may be considered the "loss," and the proportional part which each rode, the time. Now, by the Rule, each man is to bear his share of the loss (expense) in proportion as he has the use of the stock in trade (carriage). The two men had the use of the whole stock in trade for the first 20 miles, for which they pay $\frac{20}{144}$ of $\$25 = \$3.47\frac{2}{3}$; therefore, the share of each, for this distance, is $\frac{1}{2}$ of $\$3.47\frac{2}{3} = \$1.73\frac{1}{3}$. For the next 52

miles the carriage was occupied by the two gentlemen and A. The expense of the carriage for this distance was \$9.02.7 $\frac{1}{7}$, it being $\frac{12}{144}$ of \$25, of which each paid $\frac{1}{2} = \$3.00.9\frac{7}{7}$. For the next 42 miles, there were four passengers, viz. the two gentlemen, and A and B. The expense for this distance was $\frac{12}{144}$ of \$25 = \$7.29.1 $\frac{1}{2}$, and each of the four passengers paid \$1.82.2 $\frac{1}{2}$. For the remaining part of the distance, 30 miles, the expense was $\frac{30}{144}$ of \$25 = \$5.20.8 $\frac{1}{2}$; and as C has been received into the carriage, each person bears $\frac{1}{3}$ of the expense for this distance, \$1.04.1 $\frac{1}{2}$. Thus we perceive that each of the two gentlemen pays \$1.73.6 $\frac{1}{2}$ + \$3.00.9 $\frac{7}{7}$ + \$1.82.2 $\frac{1}{2}$ + \$1.04.1 $\frac{1}{2}$ = \$7.60.9 $\frac{1}{2}$; A pays \$3.00.9 $\frac{7}{7}$ + \$1.82.2 $\frac{1}{2}$ + \$1.04.1 $\frac{1}{2}$ = \$5.87.3 $\frac{1}{2}$; B pays \$1.82.2 $\frac{1}{2}$ + \$1.04.1 $\frac{1}{2}$ = \$2.86.4 $\frac{1}{2}$; C pays \$1.04.1 $\frac{1}{2}$ Ans.

FORM OF STATEMENT.

$$\frac{12}{144} \times \frac{1}{2} + \frac{12}{144} \times \frac{1}{2} + \frac{12}{144} \times \frac{1}{2} + \frac{30}{144} \times \frac{1}{3} = \frac{126}{144}, \text{ first man's product.}$$

$$\frac{12}{144} \times \frac{1}{2} + \frac{12}{144} \times \frac{1}{2} + \frac{12}{144} \times \frac{1}{2} + \frac{30}{144} \times \frac{1}{3} = \frac{126}{144}, \text{ 2d man's product.}$$

$$\frac{12}{144} \times \frac{1}{2} + \frac{12}{144} \times \frac{1}{2} + \frac{30}{144} \times \frac{1}{3} = \frac{108}{144}, \text{ A's prod.}$$

$$\frac{12}{144} \times \frac{1}{2} + \frac{30}{144} \times \frac{1}{3} = \frac{108}{144}, \text{ B's prod.}$$

$$\frac{30}{144} \times \frac{1}{3} = \frac{108}{144}, \text{ C's prod.}$$

$\frac{1728}{144}$, sum of the products.

$\frac{1728}{144} : \$25 :: \frac{126}{144} : \$7.60.9\frac{1}{2}$, first man's expense,

$\frac{1728}{144} : \$25 :: \frac{126}{144} : \$7.60.9\frac{1}{2}$, 2d man's expense,

$\frac{1728}{144} : \$25 :: \frac{108}{144} : \$5.87.3\frac{1}{2}$, A's expense,

$\frac{1728}{144} : \$25 :: \frac{108}{144} : \$2.86.4\frac{1}{2}$, B's expense,

$\frac{1728}{144} : \$25 :: \frac{108}{144} : \$1.04.1\frac{1}{2}$, C's expense,

} Ans.

6. \$4000 for 4 months, is \$100 for 160 months.
 $\$4000 + \$500 = \$4500$ for 12 months, is \$100 for 540 months; and $\$4500 - \$1000 = \$3500$ for 4 months, is \$100 for 140 months. A may therefore be considered as

having \$100 in trade $160 + 540 + 140 = 840$ months. Again, \$3000 for 10 months, is \$100 for 300 months. $\$3000 - \$1500 = \$1500$ for 4 months, is \$100 for 60 months. $\$1500 + \$3000 = \$4500$ for 6 months, is \$100 for 270 months. B may therefore be considered as having \$100 in trade for $300 + 60 + 270 = 630$ months. Again, \$2000 for 6 months, is \$100 for 120 months. $\$2000 + \$2000 = \$4000$ for 8 months, is \$100 for 320 months. $\$4000 + \$2000 = \$6000$ for 2 months, is \$100 for 120 months. $\$6000 - \$1500 = \$4500$ for 4 months, is \$100 for 180 months. C may therefore be considered as having \$100 in trade $120 + 320 + 120 + 180 = 740$ months. The sum of A, B, and C's time is $840 + 630 + 740 = 2210$ months. A's share of the gain will therefore be $\frac{840}{2210}$ of \$4420 = \$1680; B's share, $\frac{630}{2210}$ of \$4420 = \$1260; C's share $\frac{740}{2210}$ of \$4420 = \$1480 Ans.

FORM OF STATEMENT.

$$\$4000 \times 4 = 16000$$

$$\underline{500}$$

$$\underline{4500} \times 12 = 54000$$

$$\underline{1000}$$

$$\underline{3500} \times 4 = 14000$$

$$A's \text{ product} = \underline{84000}$$

$$\$3000 \times 10 = 30000$$

$$\underline{1500}$$

$$\underline{1500} \times 4 = 6000$$

$$\underline{3000}$$

$$\underline{4500} \times 6 = \underline{27000}$$

$$B's \text{ product} = \underline{63000}$$

$$\$2000 \times 6 = 12000$$

$$\underline{2000}$$

$$\underline{4000} \times 8 = 32000$$

$$\underline{2000}$$

$$\underline{6000} \times 2 = 12000$$

$$\underline{1500}$$

$$\underline{4500} \times 4 = \underline{18000}$$

$$C's \text{ product} = \underline{74000}$$

$$A's \text{ product}, \underline{84000}$$

$$B's \text{ product}, \underline{63000}$$

$$C's \text{ product}, \underline{74000}$$

$$\underline{221000}$$

$$\begin{array}{l} \$221000 : \$4420 :: \$84000 : \$1680 \text{ A's gain, } \\ \$221000 : \$4420 :: \$63000 : \$1260 \text{ B's gain, } \\ \$221000 : \$4420 :: \$74000 : \$1480 \text{ C's gain, } \end{array} \left. \begin{array}{l} \\ \\ \end{array} \right\} \text{Ans.}$$

7. \$4000 for 6 months, is \$100 for 240 months. \$4000 — \$2000 = \$2000 for 18 months, is \$100 for 360 months. Jones may therefore be considered as having \$100 in trade for $240 + 360 = 600$ months. \$3500 for 8 months, is \$100 for 280 months. \$3500 — 1500 = \$2000 for 16 months, is \$100 for 320 months. Eaton, then, may be considered as having \$100 in trade $280 + 320 = 600$ months. \$2500 for 10 months, is \$100 for 250 months. \$2500 + \$2000 = \$4500 for 14 months, is \$100 for 630 months. Brown, then, may be considered as having \$100 in trade $250 + 630 = 880$ months. As each man is supposed to have the same capital, his share of the gain will be in proportion to the *time* his \$100 has been in trade.

The sum of all their times is $600 + 600 + 880 = 2080$ months.

Jones's gain will be $\frac{600}{2080}$ of \$1041.80 = \$300.51 $\frac{1}{3}$
 Eaton's gain will be $\frac{600}{2080}$ of \$1041.80 = \$300.51 $\frac{1}{3}$
 Brown's gain will be $\frac{880}{2080}$ of \$1041.80 = \$440.76 $\frac{2}{3}$ } Ans.

FORM OF STATEMENT.

$$\begin{array}{r} \$4000 \times 6 = 24000 \\ \underline{2000} \\ 2000 \times 18 = 36000 \end{array}$$

$$\begin{array}{r} \$3500 \times 8 = 28000 \\ \underline{1500} \\ 2000 \times 16 = 32000 \end{array}$$

$$\text{Jones's product} = 60000$$

$$\text{Eaton's product} = 60000$$

$$\begin{array}{r} \$2500 \times 10 = 25000 \\ \underline{2000} \\ 4500 \times 14 = 63000 \end{array}$$

$$60000$$

$$60000$$

$$88000$$

$$\text{Brown's product} = 88000 \quad \text{Sum of the products} = 208000$$

208000 : \$ 1041.80 :: 60000 : \$ 300.51 $\frac{1}{2}$ Jones's gain, }
 208000 : \$ 1041.80 :: 60000 : \$ 300.51 $\frac{1}{2}$ Eaton's gain, } Ans.
 208000 : \$ 1041.80 :: 88000 : \$ 440.76 $\frac{2}{3}$ Brown's gain, }

SECTION LVIII.

PROFIT AND LOSS.

10. (p. 232.) \$ 7.00 : \$ 6.12 $\frac{5}{7}$:: \$ 100 : \$ 87.50; \$ 100 — \$ 87.50 = \$ 12.50 per cent. Ans.
11. \$ 1.00 — .12 $\frac{5}{7}$ = .87.5; \$ 7.00 \times .87.5 = \$ 6.12 $\frac{5}{7}$ Ans.
12. \$ 3.60 \times 1.12 $\frac{5}{7}$ = \$ 4.05 Ans.
13. \$ 4.05 is $\frac{100}{112\frac{5}{7}}$ of the original cost; therefore, $\frac{100}{112\frac{5}{7}}$ of 4.05 = \$ 3.60 Ans.
14. \$ 8.50 \times 1.10 = \$ 9.35 Ans.
15. \$ 9.35 + 1.10 = \$ 8.50 Ans.
16. \$ 1.00 — .15 = .85; \$ 1.25 + .85 = \$ 1.47 $\frac{1}{7}$; \$ 1.47 $\frac{1}{7}$ \times 1.12 = \$ 1.64.7 $\frac{1}{7}$ Ans.
17. \$ 1.00 — .15 = .85; \$ 1.25 + .85 = \$ 1.47 $\frac{1}{7}$, value of the cloth; \$ 1.64.7 $\frac{1}{7}$ — \$ 1.47 $\frac{1}{7}$ = \$ 0.17.6 $\frac{8}{7}$; \$ 1.47 $\frac{1}{7}$: \$ 0.17.6 $\frac{8}{7}$:: \$ 100 : \$ 12 per cent. Ans.
18. As 12 per cent. was gained on the cloth, $\frac{112}{100}$ of \$ 1.64.7 $\frac{1}{7}$ = \$ 1.47 $\frac{1}{7}$, cost; and $\frac{85}{100} \times \$ 1.47\frac{1}{7} = \$ 1.25$, price for which it is sold, Ans.
19. \$ 1.64.7 $\frac{1}{7}$ \div 1.12 = \$ 1.47 $\frac{1}{7}$ — \$ 1.25 = \$ 0.22 $\frac{1}{7}$; \$ 1.47 $\frac{1}{7}$: \$ 0.22 $\frac{1}{7}$:: \$ 100 : \$ 15 per cent. Ans.
20. \$ 0.90 : \$ 1.20 :: \$ 100 : \$ 133 $\frac{1}{3}$ — \$ 100 = \$ 33 $\frac{1}{3}$ per cent.; \$ 1.12 $\frac{5}{7}$: \$ 1.50 :: \$ 100 : \$ 133 $\frac{1}{3}$ — \$ 100 = \$ 33 $\frac{1}{3}$ per cent. Both have gained \$ 33 $\frac{1}{3}$ per cent. Ans.
21. The present worth of 13 cents due 8 months hence is $13 \div 1.04 = .12\frac{5}{7}$ cents. If, therefore, the cotton cost 12 $\frac{5}{7}$ cents, and is sold for 12 cents, on each yard there is lost .125 — .12 = .005 = $\frac{5}{1000}$ = .04 = 4 per cent. Ans.

22. $\$2.50 \times 24 = \60.00 , price sold at. As the cloth was sold at $7\frac{1}{2}$ per cent. loss, it is evident $\$60.00$ is $\frac{92\frac{1}{2}}{100}$ of the cost; therefore, $\frac{100}{92\frac{1}{2}}$ of $\$60.00 = \$64.86,43\frac{7}{8}$ is the cost, Ans.
23. It is evident, if $7\frac{1}{2}$ per cent. be taken from any sum, $92\frac{1}{2}$ per cent. will remain; therefore, $.92\frac{1}{2} \times \$64.86,43\frac{7}{8} = \60 , price sold at; $\$60.00 \div 24 = \2.50 per yard, Ans.
24. By the last question, we perceive, that, if $7\frac{1}{2}$ per cent. be lost on $\$64.86,43\frac{7}{8}$, $\$60$ will be left; and if this be divided by $\$2.50$, we shall have the number of yards; thus, $\$60 \div \$2.50 = 24$ yards, Ans.
25. $\$64.86,43\frac{7}{8}$ was given for the cloth, and $\$2.50 \times 24 = \60.00 was received for it; therefore the loss was $\$64.86,43\frac{7}{8} - \$60.00 = \$4.86,43\frac{7}{8}$, or $\frac{48643\frac{7}{8}}{60000}$ of its value, $= .075 = 7\frac{1}{2}$ per cent. Ans.
26. If 17 per cent. be added to any sum, it is evident the original sum must be $\frac{100}{117}$ of the amount; therefore, $\frac{100}{117}$ of $\$12.50 = \$10.68,38\frac{8}{117}$ = the first cost, Ans.
27. If, on any sum, 25 per cent. has been lost, the original sum must have been $\frac{100}{75}$ of it. Therefore, $\frac{100}{75}$ of $\$75 = \100 was the price of the horse. But his real value was $\$100 \times 1.30 = \130 ; therefore he was sold for $\$130 - \$75 = \$55$ less than his value, Ans.
28. As the horse was worth 30 per cent. more than was given for him, and as he was sold for 25 per cent. less than he cost, these relative prices may be expressed thus: $\frac{130}{100}$, $\frac{75}{100}$; and their difference thus: $\frac{130}{100} - \frac{75}{100} = \frac{55}{100}$. Therefore, $\frac{55}{100} : \frac{75}{100} :: \$55 : \$75$ Ans.
29. $\$0.42 \times .95 = \$0.39,9$ Ans.
30. 63gal. — 15gal. = 48gal. remaining; $\$112 \div 48 = \$2.33\frac{1}{3} \times .95 = \$2.21,6\frac{2}{3}$ Ans.
31. $\$112 \times .95 = \106.40 received for the molasses; $\$106.40 \div \$2.21,6\frac{2}{3} = 48$ gal. remaining; 63gal. — 48gal. = 15gal. leaked out, Ans.

32. 63gal. — 15gal. = 48gal. left; $\$ 2.21,6\frac{2}{3} \times 48 = \$ 106.40$;
 $\$ 106.40 \div .95 = \$ 112$ Ans.
33. 63gal. — 15gal. = 48gal.; $\$ 2.21,6\frac{2}{3} \times 48 = \$ 106.40$,
 price sold at; $\$ 112 - \$ 106.40 = \$ 5.60$, loss; $\$ 112 : \$ 5.60 :: \$ 100 : \$ 5$ loss per cent. Ans.
34. $\$ 5.60 \div .93 = \$ 6.02\frac{1}{3}$ value per yard; $\$ 6.25 - \$ 6.02\frac{1}{3} = \$ 0.22\frac{2}{3}$ gain on each yard; and $\frac{22\frac{2}{3}}{602\frac{1}{3}} = \frac{17}{448} = .03\frac{8}{9} = \$ 3\frac{8}{112}$ gain per cent. Ans.
 Or, $\$ 6.02\frac{1}{3} : \$ 0.22\frac{2}{3} :: \$ 100 : \$ 3\frac{8}{112}$ gain per cent.
 Ans.
35. $\$ 35 \div 1.04 = \$ 33.65,3\frac{1}{3}$ present worth of $\$ 35$;
 $\$ 33.65,3\frac{1}{3} - \$ 30 = \$ 3.65,3\frac{1}{3}$ gain, Ans.
36. $\$ 1.25 \div .75 = \$ 1.66\frac{2}{3}$, value of the tea; $\$ 1.66\frac{2}{3} - \$ 1.40 = \$ 0.26\frac{2}{3}$ loss per pound. Therefore, $\frac{26\frac{2}{3}}{166\frac{2}{3}} = \frac{8}{50} = .16 = \$ 16$ per cent. loss, Ans.
 Or, $\$ 1.66\frac{2}{3} : \$ 0.26\frac{2}{3} :: \$ 100 : \$ 16$ per cent. loss, Ans.
37. $\$ 1.35 \times .88 = \$ 1.18,8$, price for $\frac{1}{3}$ in ready money;
 $\$ 1.18,8 : \$ 1.00 :: \$ 5.00 : \$ 4.20\frac{2}{3}$, cash price of 1
 yard; $\$ 1.18,8 \times 50 = \$ 59.40$, value of the indigo;
 $\$ 59.40 \div 3 = \$ 19.80$; $\$ 59.40 - \$ 19.80 = \$ 39.60$;
 $\$ 39.60 \div \$ 5.00 = 7\frac{2}{3}$ yards delivered by B, Ans.

SECTION LIX.

DUODECIMALS.

2. (p. 235.) 29ft. 0' 4".
3. 66ft. 4' 6".
4. 44ft. 0' 10".
5. 79ft. 11' 0" 6" 6"".
6. 745ft. 6' 10" 2" 4"".
7. 1176ft. 1' 6".
8. 10ft. 2' 10".
9. 20ft. + 14ft. 6' = 34ft. 6' \times 2 = 69ft. \times 10ft. 4' =
 713ft.; 3ft. 2' \times 6ft. \times 2 = 38ft.; 4ft. 4' \times 4ft. =

17ft. 4' + 38ft. = 55ft. 4'; 713ft. - 55ft. 4' = 657ft. 8' ÷ 9 = 73 $\frac{3}{7}$ yards, Ans.

10. 53ft. 6' × 10ft. 3' × 2ft. = 1096ft. 9' Ans.

11. 6ft. 8' + 5ft. 9' + 4ft. 6' + 3ft. 10' = 20ft. 9' × 3ft. 5' × 4 = 283ft. 7' Ans.

12. 3ft. 4' + 2ft. 10' = 6ft. 2' × 2 = 12ft. 4' × 7ft. 9' = 95ft. 7'; 3ft. 4' × 2ft. 10' × 2 = 18ft. 10' 8" + 95ft. 7" = 114ft. 5' 8" × 15 = 1717ft. 1' square feet; 3ft. 4' × 2ft. 10' × 7ft. 9' × 15 = 1097ft. 11' ÷ 27 = 40 $\frac{11}{27}$ cubic yards, Ans.

13. 20ft. + 16ft. 6' = 36ft. 6' × 2 = 73ft. × 9ft. 6' = 693ft. 6'; 20ft. × 16ft. 6' = 330ft.; 330ft. + 693ft. 6' = 1023ft. 6' × 3 = 3070ft. 6' ÷ 9 = 341yd. 1ft. 6'; 341yd. 1ft. 6' - 90yd. = 251yd. 1ft. 6' Ans.

14. 17ft. 6' × 1ft. 7' = 27ft. 8' 6" Ans.

15. 27ft. 9' × 2ft. 5' = 67ft. 0' 9" Ans.

16. 47ft. × 17ft. 9" = 834ft. 3' Ans.

17. 18ft. 9" × 1ft. 6' × 3 = 84ft. 4' 6" Ans.

18. 20ft. × 1ft. 6' × 2 $\frac{1}{2}$ = 75ft. Ans.

19. 40ft. 6' × 2ft. 6" × 2 $\frac{1}{4}$ = 278ft. 5' 3" Ans.

20. 18ft. × 6ft. × 4ft. = 432ft. ÷ 128 = 3 $\frac{3}{8}$ cords, Ans.

21. 10ft. × 5ft. × 7ft. = 350ft. ÷ 128 = 2 cords 94 cubic feet, Ans.

22. 35ft. × 4ft. × 4ft. = 560ft. ÷ 128 = 4 $\frac{1}{8}$ cords, Ans.

23. 8ft. × 8ft. × 8ft. = 512ft. ÷ 128 = 4 cords, Ans.

24. 10ft. × 10ft. × 10ft. = 1000ft. ÷ 128 = 7 $\frac{1}{8}$ cords, Ans.

25. 70ft. 6" × 5ft. 3" = 370ft. 1' 4" ÷ 4 = 92 $\frac{5}{8}$ cord feet; 92 $\frac{5}{8}$ ÷ 8 = 11 $\frac{5}{8}$ cords, Ans.

26. 97ft. 9" × 3ft. 6" = 342ft. 1' 6" ÷ 4 = 85 $\frac{1}{2}$ cord feet ÷ 8 = 10 $\frac{1}{2}$ cords, Ans.

27. 100ft. × 6ft. 11" = 691ft. 8" ÷ 4 = 172 $\frac{1}{4}$ cord feet ÷ 8 = 21 $\frac{1}{4}$ cords, Ans.

28. 8ft. × 4ft. × 10 = 320ft. × 2" = 53 $\frac{1}{2}$ ft. × 5 = 266 $\frac{1}{2}$ ÷ 128 = 82.08 $\frac{1}{2}$ Ans.

29. $3\text{ft. } 8' \times 5\text{ft.} = 18\text{ft. } 4' \div 2 = 9\frac{1}{2}$ feet, Ans.
 30. $3\text{ft. } 10' \times 6\text{ft. } 6' = 24\text{ft. } 11' \div 2 = 12\frac{1}{4}$ feet, Ans.
 31. $128\text{ft.} \div 8 = 16\text{ft.} \div 3\text{ft. } 6' = 4\text{ft. } 6' 10\frac{1}{2}"$ Ans.
 32. $128\text{ft.} \times 2 = 256\text{ft.} \div 12 = 21\text{ft. } 4' \div 3\text{ft. } 9' = 5\text{ft. } 8\frac{3}{4}"$ Ans.
 33. $14\text{ft. } 8\text{in.} + 17\text{ft. } 9\text{in.} = 32\text{ft. } 5\text{in.}$; $32\text{ft. } 5\text{in.} \times 2 = 64\text{ft. } 10\text{in.}$, length round the room; $64\text{ft. } 10\text{in.} \times 8\text{ft. } 9\text{in.} = 567\text{ft. } 3\frac{1}{2}\text{in.}$, contents of the upright parts of the room; $17\text{ft. } 9\text{in.} \times 14\text{ft. } 8\text{in.} = 260\text{ft. } 4\text{in.}$, contents of the upper part of the room; $7\text{ft.} \times 3\text{ft. } 4\text{in.} \times 2 = 46\text{ft. } 8\text{in.}$, contents of the doors; $5\text{ft. } 3\text{in.} \times 3\text{ft. } 4\text{in.} \times 4 = 70\text{ft.}$, contents of the windows; $64\text{ft. } 10\text{in.} - 6\text{ft. } 8\text{in.} = 58\text{ft. } 2\text{in.}$, length of the mop-boards; $58\text{ft. } 2\text{in.} \times 0\text{ft. } 9\text{in.} = 43\text{ft. } 7\frac{1}{2}\text{in.}$, contents of the mop-boards; $46\text{ft. } 8\text{in.} + 43\text{ft. } 7\frac{1}{2}\text{in.} = 160\text{ft. } 3\frac{1}{2}\text{in.}$; $567\text{ft. } 3\frac{1}{2}\text{in.} + 260\text{ft. } 4\text{in.} = 827\text{ft. } 7\frac{1}{2}\text{in.}$; $827\text{ft. } 7\frac{1}{2}\text{in.} - 160\text{ft. } 3\frac{1}{2}\text{in.} = 667\text{ft. } 4\text{in.}$; $667\text{ft. } 4\text{in.} \div 9 = 74\frac{1}{4}$ yards of plastering; $74\frac{1}{4} \times .10 = \$ 7.41\frac{1}{4}$, cost of the plastering. $567\text{ft. } 3\frac{1}{2}\text{in.} - 160\text{ft. } 3\frac{1}{2}\text{in.} = 407\text{ft.}$; $3\text{ft.} \times 1\text{ft. } 8\text{in.} = 5\text{ft.}$; $407\text{ft.} \div 5 = 81\frac{1}{2}$ yards of paper; $81\frac{1}{2} \times .06\frac{1}{4} = \$ 5.08\frac{1}{4}$, cost of the paper. $407 \div 9 = 45\frac{2}{3}$; $45\frac{2}{3} \times .04 = \$ 1.80\frac{2}{3}$, cost of papering. $14\text{in.} \times 10\text{in.} \times 4 \times 12 = 6720\text{in.}$; $6720\text{in.} \div 144 = 46\frac{2}{3}\text{ft.}$; $46\frac{2}{3} \times .12\frac{1}{2} = \$ 5.83\frac{1}{2}$, cost of the glass; $48 \times .08 = \$ 3.84$, cost of setting the glass. The contents of the floor will be equal to the upper part of the room, $260\text{ft. } 4\text{in.}$; $260\text{ft. } 4\text{in.} + 46\text{ft. } 8\text{in.} + 43\text{ft. } 7\frac{1}{2}\text{in.} = 350\text{ft. } 7\frac{1}{2}\text{in.}$, the part to be painted; $350\text{ft. } 7\frac{1}{2}\text{in.} \times .25 = \$ 9.73\frac{1}{4}$, cost of painting. $\$ 7.41\frac{1}{4} + \$ 5.08\frac{1}{4} + \$ 1.80\frac{2}{3} + \$ 5.83\frac{1}{2} + \$ 3.84 + \$ 9.73\frac{1}{4} = \$ 33.72\frac{8}{15}$ Ans.

SECTION LX.

INVOLUTION.

2. (p. 238.)	512	4.	15625
3.	282475249	5.	64

6.	$\frac{2}{3}$	9.	.000004100625
7.	$50\frac{4}{9}$	10.	1
8.	$16\frac{144}{15625}$		

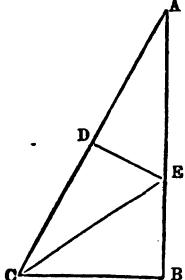
SECTION LXI.

EXTRACTION OF THE SQUARE ROOT.

4. (p. 244.)	881	15.	756439
5.	999	16.	$\frac{4}{1}$
6.	3216	17.	$\frac{1}{12}$
7.	3105671	18.	$6\frac{1}{2}$
8.	15.3	19.	$7\frac{1}{4}$
9.	.027	20.	$9\frac{3}{4}$
10.	4.16	21.	$19\frac{1}{19}$
11.	19.3132079+	22.	2.5298+
12.	2.98831055+	23.	2.9519+
13.	1.4	24.	1.41421+
14.	1.77482393+		

25. $\sqrt{141376} = 376$ Ans.
 26. $1760 \times 9 = 15840$; $\sqrt{15840} = 125.857+$ feet, Ans.
 27. $24 \times 24 = 576 \div 2 = 288$; $\sqrt{288} = 16.97+$ in. Ans.
 28. $2 : 3 :: 2400 : 3600$; $\sqrt{3600} = 60$ trees in length.
 $3 : 2 :: 2400 : 1600$; $\sqrt{1600} = 40$ trees in breadth.
 $60 - 1 = 59 \times 7 = 413$; $40 - 1 = 39 \times 7 = 273$;
 $413 \times 273 = 112749$ square yards, Ans.
 29. $2 : 3 :: \frac{3}{4} \times \frac{3}{4} = \frac{9}{16} : \frac{27}{32} = .84375$; $\sqrt{.84375} = .918+$ in. Ans.
 30. $2 \times 2 = 4 : 1.5 \times 1.5 = 2.25 :: 50\text{m.} : 28.125\text{m.} = 28\text{m. } 7\frac{1}{2}\text{sec.}$ Ans.
 31. $4 \times 4 \times 3 = 48 : 6 \times 6 \times 2 = 72 :: 4\text{h.} : 6\text{h.}$ Ans.
 32. $144 \times 144 = 20736$; $64 \times 64 = 4096$; $20736 - 4096 = 16640$;
 $\sqrt{16640} = 128.99+$ feet, Ans.

33. $20 \times 20 = 400$; $16 \times 16 = 256$; $12 \times 12 = 144$;
 $400 + 256 + 144 = 800$; $\sqrt{800} = 28.28+$ feet, Ans.
34. $128 \times 128 = 16384$; $72 \times 72 = 5184$ + $16384 = 21568$; $\sqrt{21568} = 146.86+$ miles, Ans.
35. $100 \times 100 = 10000$; $70 - 5 = 65$; $65 \times 65 = 4225$;
 $10000 - 4225 = 5775$; $\sqrt{5775} = 75.993420+$; $80 \times 80 = 6400$; $50 - 5 = 45$; $45 \times 45 = 2025$;
 $6400 - 2025 = 4375$; $\sqrt{4375} = 66.143782+$;
 $75.993420 + 66.143782 = 142.137202 \times 142.137202$
 $= 20202.984192388804$; $70 - 50 = 20$; $20 \times 20 = 400$;
 $20202.984192388804 + 400 = 20602.9841923-88804$;
 $\sqrt{20602.984192388804} = 143.537396+$ feet,
Ans.
36. $400 \times 400 = 160000$; $160 \times 160 = 25600$; $160000 - 25600 = 134400$; $\sqrt{134400} = 366.6 - 50 = 316.6$
Ans.
37. $70 \times 70 = 4900$; $40 \times 40 = 1600$; $30 \times 30 = 900$;
 $4900 - 1600 = 3300$; $\sqrt{3300} = 57.445+$; $4900 - 900 = 4000$; $\sqrt{4000} = 63.245$ + $57.445 = 120.69+$
feet, Ans.
38. $\frac{1}{10} \times \frac{1}{10} = \frac{1}{100}$: 1² in. :: 450lb. : 45000lb. Ans.
39. Let A B represent the height of the tree, E the top of the stump, C the point on which the top of the tree will fall. As the tree will rest on the stump, it is evident that A E will be equal to C E. By drawing D E at right angles to A C, it is evident that A D will be equal to D C; that is, the line A C is bisected in D; therefore we have two similar triangles, A B C and A D E. This is evident from the fact, that each of these triangles has one right angle, and that the angle A is common to both triangles. Therefore as A B is to A C, so is A D to A E. If, then, we take A E from A B, the remainder E B will be the answer required.



OPERATION.

A B is 80 and B C is 40; therefore A C will be equal to the square root of the sum of the squares of A B and B C; that is $80^2 + 40^2 = 6400 + 1600 = 8000 = \sqrt{8000} = 89.44+$ $= AC$; A D will, therefore, be $44.72+$. Then, as $80 : 89.44 :: 44.72+ : 49.9+$, and if the fractions could all have been taken into the above operation, the fourth term would have been 50 feet. Therefore, $80 - 50 = 30$ feet, Ans.

BY ALGEBRA.

Let x represent B E, $80 - x = CE$, and $40 = CB$. Then
 $\overline{80 - x - x^2}^2 = 40^2$; $6400 - 16x + x^2 - x^2 = 1600$. And
 $160x = 6400 - 1600 = 4800$.

$$x = 30 \text{ feet} = BE, \text{ Ans.}$$

40. Circles being to each other as the squares of their diameters, they are also to each other as the squares of their semidiameters. The grindstone being 48 inches in diameter, its semidiameter will be 24 inches. $24 \times 24 = 576 \div 4 = 144$; $576 - 144 = 432$, $\sqrt{432} = 20.78$ = to the semidiameter that will be left after A has ground off his share; therefore his share will be $24 - 20.78 = 3.22$ in.; $432 - 144 = 288$; $\sqrt{288} = 16.97$; $20.78 - 16.97 = 3.81$ in., B's share; $288 - 144 = 144$; $\sqrt{144} = 12$ in.; $16.97 - 12 = 4.97$ in., C's share; $\sqrt{144} = 12$ in., D's share, Ans.

41. $160 + .785398 = 203.71836$; $\sqrt{203.71836} = 14.273+$; $14.273 \div 2 = 7.136+$ rods, Ans.

42. We first find the number of square feet in an acre, $160 \times 272\frac{1}{4} = 43560$ feet. If we extract the square root of this number we obtain the side of a square field, that will contain an acre; thus, $\sqrt{43560} = 208.712+$ feet. We now divide this number by 3.5 feet, and obtain $59.632+$, the number of divisions in the first row. We perceive, therefore, that there will be 60 hills, there being one more hill than divisions. Now, if we divide $208.712+$ by 59, the quotient will be 3.537 feet;

that is, the hills in the first row may be 3.537 feet apart, instead of 3.5 feet. Thus, our first row will contain 60 hills, which will be 3.537 feet apart. Our next row will contain but 59 hills, the hills being planted in the quincunx order, thus: —



To find the distance between the rows, we square $3.5 = 12.25$; we then take half of $3.537 = 1.768$, which we square $= 3.125824$; we subtract this last number from 12.25 and obtain 9.124176 . The square root of this number is 3.0206 feet, equal the distance between the rows. Now, if we divide $208.712+$ by 3.0206, we obtain $69+$; therefore, the number of rows will be 70. To obtain the number of hills in the field, we multiply 70 by 60 $= 4200$. But as there are 70 rows, and as half of the rows contain only 59 hills, we subtract 35 from 4200. Thus, $4200 - 35 = 4165$ hills, Ans.

43. The pupil, to understand this problem, will first obtain the number of feet in the diameter of the garden; $10 \times 16.5 = 165$ feet; $165 - 5 = 160$. The trees are, therefore, to be set on a piece of ground 160 feet in diameter. Let the pupil place 1 tree in the centre of the garden, around this let him place 6 other trees, at the distance of 10 feet from each other; he will then perceive, that they stand in a hexagonal form. Let him enlarge this hexagon by placing another row of trees around it at the distance of 10 feet each; and this will require 12 additional trees. If we examine this hexagon, we shall find that each side of it contains 3 trees. Let us enlarge this hexagon, by placing another row of trees around it, and we shall find it will require 18 trees, and that each side of the hexagon contains 4 trees. We continue thus to enlarge the hexagon, until we have set 8 rows round the centre tree. Each side of the hexagon will then contain 9 trees. To compute the number of trees in the hexagon, we find the number of trees that compose the periphery of the first hexa-

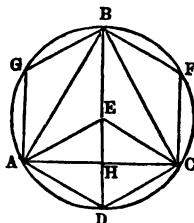
gon to be 6 trees; and the number that compose the periphery of the larger hexagon to be 48. We therefore add 6 to 48, and multiply the sum by the half of 8 = 4; thus, $6 + 48 = 54$; $54 \times 4 = 216$. To this we add the tree in the centre, $216 + 1 = 217$. If we now examine our figure, we find we can set 4 more trees at the base of each side of the hexagon, within the limits of the prescribed field. Therefore, 4 times 6 = 24, to be added to 217, thus $217 + 24 = 241$ trees, Ans.

44. In performing this question, we first find the ratio which the perpendicular height of an equilateral triangle has to one of its sides. Let A G B F C D be a circle, and E the centre. From the point A in the circumference, apply the radius A E six times to the circumference, and join A G, G B, B F, F C, C D, and D A, and the figure A G B F C D thus formed is an equilateral inscribed hexagon. Join the alternate angles A B, B C, and C A, and the figure A B C thus formed is an equilateral triangle inscribed. It is equilateral because the three sides subtend the equal arches of the circumference.

A E C D is a rhombus, and the diagonal E D is equal to either side of the rhombus. If, therefore, the diameter of the circle B D is 1, the semidiameter E D or B E will be .5; and E H, which is half of E D, will be .25. And as B E is .5 and E H is .25, it is evident that B H is .75, or three fourths of B D, and that E H is one third of B H. If, therefore, we wish to find a point in an equilateral triangle which is at equal distances from the angles, we have only to find the perpendicular height of the triangle B H, and then take one third of this distance and set it off from H to E. E then is at equal distances from A, B, and C.

To find the ratio which A B has to B H, we assume A B to be 1; A H, which is half of A C or A B, will be .5. But

Fig. 1.



$A B H$ is a right-angled triangle, therefore BH is equal to the square root of the difference of the squares of AB and AH . Thus, $BH = \sqrt{AB^2 - AH^2} = \sqrt{1^2 - .5^2} = \sqrt{1 - .25} = \sqrt{.75} = .8660254$. If, therefore, we multiply the side of any equilateral triangle by .8660254, the product will be its perpendicular height. Q. E. D.

Let $A B C$ be an equilateral triangle, whose sides are 200 feet. Let the tower at A be 30 feet high, the one at B 40 feet high, and the one at C 50 feet. Bisect AB in D , BC in E , and CA in H . Draw CD , BH , and AE . The point M will be the centre of the triangle, and the lines MA , MC , and MB will be equal to each other. The line CD will be $200 \times .8660254 = 173.20508$ feet, and MD will be $\frac{1}{3}$ of $173.20508 = 57.73502$ feet. As the tower at A is 30 feet high, and the one at B 40 feet, we first ascertain a point F , which shall be equally distant from the top of the tower at A , and the top of the tower at B ; and this we do by similarity of triangles, thus:—

Construct the figure $ABDH$.

Make AB 200 feet, AH 30 feet, and BD 40 feet. Draw HC parallel to AB . BC will be 30 feet, and CD 10 feet. Take the point F at equal distances from A and B ; AF or FB will be 100 feet. Draw FE at right angles to AB . It will readily be perceived that EF is 35 feet. Draw EG , making the angle FEG equal to the angle CHD . Then, by similarity of triangles, HC will be to DC as EF to FG ; that is, as $200\text{ft.} : 10\text{ft.} :: 35\text{ft.} :$

Fig. 2.

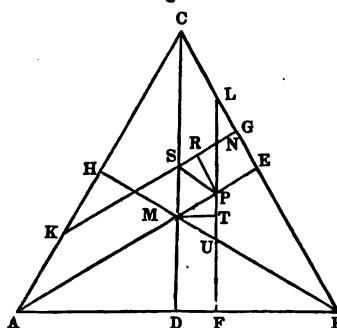
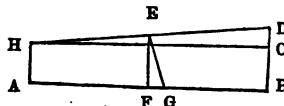


Fig. 3.



1.75ft. = the distance from F to G. Let F (Fig. 2), then, be a point in the line A B, which is 1.75 feet from D. A F will then be 101.75 feet, and F B, 98.25 feet. Draw F L parallel to D C ; any point, therefore, in the line F L will be equally distant from the top of the towers at A and B. By a process similar to the above, we find the distance E G to be 2.25 feet. Thus, 200ft. : 10ft. :: 45ft. : 2.25ft. We draw G K parallel to E A ; and as the point G is equally distant from the top of the towers at B and C, it is evident, that if any point be taken in the line G K, it will also be equally distant from the summit of said towers. Let this point be N. We have before shown, that any point in the line F L will be equally distant from the top of the towers at A and B. Let this point also be N. Therefore, the point N is equally distant from the summit of the three towers at A, B, and C. S P N is an equilateral triangle, and its perpendicular height R P, which is equal to G E, is 2.25 feet. As we have before found, the ratio of the side of an equilateral triangle to its perpendicular height is as 1 to .8660254 ; we therefore infer, that the ratio of the perpendicular height of an equilateral triangle is to one of its sides as .8660254 to 1. Then, as .8660254 : 1 :: R P : N P = .8660254 : 1 :: 2.25 : 2.598076 = N P. To find P T, which is half of P U, we say, as .8660254 : .5 :: M T : P T ; that is, as .8660254 : .5 :: 1.75 : 1.010362 = P T. We now add F T, P T, and P N together, $57.73502 + 1.010362 + 2.598076 = 61.343458 = N F$.

As N F B is a right-angled triangle, N B will be equal to the square root of the sum of the squares of F N and F B. That is, $N B = \sqrt{(N F^2 + F B^2)} = \sqrt{(61.343458^2 + 98.25^2)} = \sqrt{(3763.019839397764 + 9653.0625)} = 115.8277+$.

To find the length of the ladder, which is to extend from the point N to the top of the tower B, as it is the hypotenuse of a right-angled triangle, we square N B, which we have found above to be equal to the sum of the squares of N F and B F = 13416.082339397764, and also square the height of

the tower B = 1600. We find the sum of these squares to be 15016.082339397764 . The square root of this number will be a line extending from N to the top of the tower B, which is the length of the ladder required. $\sqrt{15016.082339397764} = 122.54+$. To find the line NC, from the square of the length of the ladder we subtract the square of the height of the tower C, and then extract the square root of the remainder. Thus, $15016.082339397764 - 2500 = 12516.082339397764$; $\sqrt{12516.082339397764} = 111.875+$ feet. To find the distance NA, we subtract the square of the height of the tower A from the square of the length of the ladder, and then extract the square root of the remainder. Thus, $15016.082339397764 - 900 = 14116.082339397764$; $\sqrt{14116.082339397764} = 118.811+$ feet. We therefore find the distance from the point N to the first tower A to be 118.811+ feet; to the second tower, B, 115.827+ feet; to the third tower, C, 111.875+ feet. Length of the ladder 122.54+ feet. Ans.

SECTION LXII.

EXTRACTION OF THE CUBE ROOT.

2. (p. 251.) 327	11.	2.2239+	21.	57
3. 7583	12.	4968	22.	62
4. 4.39	13.	+	23.	64
5. 379	14.	++	24.	73
6. 392	15.	+	25.	74
7. 478	16.	++	26.	81
8. 4.89	19.	53	27.	29
9. .899	20.	56	28.	35
10. 1.2599+				

29. $3 \times 3 \times 3 = 27 : 6 \times 6 \times 6 = 216 :: 4\text{lb.} : 32\text{lb.}$ Ans.

30. $1 \times 1 \times 1 = 1 : 3.5 \times 3.5 \times 3.5 = 42.875 :: \$120 : \$5145$ Ans.

31. 5ft. 10in. = 70in.; 10ft. 4 $\frac{1}{2}$ in. = 124.6in.; 70 \times 70 \times 70 = 343000; 124.6 \times 124.6 \times 124.6 = 1934434.936; 343000 : 1934434.936 :: 180lb. : 1015.1+lb. Ans.

32. 2lb. : 2000lb. :: 4 \times 4 \times 4 = 64in. : 64000;

$$\sqrt[3]{64000} = 40\text{in.} = 3\text{ft. 4in. high;}$$

2lb. : 2000lb. :: 3 \times 3 \times 3 = 27in. : 27000in.;

$$\sqrt[3]{27000} = 30\text{in.} = 2\text{ft. 6in. wide;}$$

2lb. : 2000lb. :: $\frac{1}{4} \times \frac{1}{4} \times \frac{1}{4} = \frac{1}{64}$: $\frac{1000}{64}$;

$$\sqrt[3]{\frac{1000}{64}} = \frac{10}{4} = 2\frac{1}{2}\text{in. thick, Ans.}$$

33. 5 \times 5 \times 5 = 125ft. : 20 \times 20 \times 20 = 8000ft. :: 1cwt. : 64cwt. Ans.

34. 6 \times 6 \times 6 = 216ft. : 10 \times 10 \times 10 = 1000ft. :: 1 day : 4.629+ days, Ans.

35. 6 \times 6 \times 6 = 216ft. : 8 \times 8 \times 8 = 512ft. :: 600lb. : 1422.2+lb. Ans.

36. 5 \times 5 \times 5 = 125; 125 \div 4 = 31.25; 125 — 31.25 = 93.75; $\sqrt[3]{93.75} = 4.542+$; 5 — 4.542 = .45+ inches, the first woman's share. 93.75 — 31.25 = 62.50; $\sqrt[3]{62.50} = 3.968$; 4.542 — 3.968 = .57+ inches, share of the second woman. 62.50 — 31.25 = 31.25; $\sqrt[3]{31.25} = 3.149$; 3.968 — 3.149 = .82+ inches, third woman's share. 3.149+ inches, fourth woman's share.

37. If Wells have 100 per cent. Rowe will have 108 per cent., and Northend 110 per cent. But Pierce has 10 per cent. more than Rowe, therefore he will have 108 \times 1.10 = 118.8 per cent. 118.8 + 108 + 100 + 110 = 436.8; 5 tons = 100cwt.

Then 436.8 : 118.8 :: 100cwt. : $27\frac{54}{63}$ cwt. for Pierce.

And 436.8 : 108 :: 100cwt. : $24\frac{18}{27}$ cwt. for Rowe.

And 436.8 : 100 :: 100cwt. : $22\frac{24}{27}$ cwt. for Wells.

And 436.8 : 110 :: 100cwt. : $25\frac{50}{63}$ cwt. for Northend.

To find the feet in height that each must take, we adopt the following rule, and say, As the relative value of all their shares is to the relative value of each share, so is the cube of the height of the pyramid or stack to the cube of the height

of each man's part of the stack. But we are to compute from the top of the stack each time, and then subtract as in the following process : —

$16 \times 16 \times 16 = 4096$ feet, cube of the height of the stack.
 $436.8 : 118.8 :: 4096 : 1114.02197$; $\sqrt[3]{1114.02197} = 10.366+$ feet in height for Pierce.

$436.8 : 118.8 + 108 = 226.8 :: 4096 : 2126.76923076$;
 $\sqrt[3]{2126.76923076} = 12.859+$ from the top of the stack.
 From this number we subtract the height of Pierce's stack,
 $12.859 - 10.366 = 2.493$ feet, for the height of Rowe's stack.
 $436.8 : 118.8 + 108 + 100 = 326.8 :: 4096 : 3064.49816849$;
 $\sqrt[3]{3064.49816849} = 14.525$ feet from the top of the stack.
 From this we subtract the height of the other two stacks;
 $14.525 - 12.859 = 1.666$ feet for the height of Wells's stack.

If, from the height of the stack, 16 feet, we subtract the last root, we have the remaining height of the stack for Northend; thus, $16 - 14.525+ = 1.474$ feet, height of Northend's stack.

NOTE. — The decimals in the answer to the above question will vary according to the degree of accuracy required.

A GENERAL RULE FOR EXTRACTING THE ROOTS OF ALL POWERS.

3. (p. 256.)
 $281950621875(195$ Ans.

$$\begin{array}{r} 1 \\ 5)271 \\ \hline 1 \\ 19^4 \times 5 = \quad 5)271 \quad = 1 \text{st subtrahend.} \\ 19^5 \quad = \quad 2476099 \quad = 1 \text{st dividend.} \\ 19^4 \times 5 = 651605 \quad 3434072 \quad = 2 \text{d subtrahend.} \\ 195^5 \quad = \quad , 281950621875 = 3 \text{d subtrahend.} \end{array}$$

$$\begin{array}{r} 4. \\ 1178420166015625(325 \text{ Ans.} \\ 3^6 \quad = \quad 729 \\ 3^5 \times 6 = \quad 1458)4494 \\ 32^6 \quad = \quad 1073741824 \\ 32^5 \times 6 = 201326592)1046783420 \\ 325^6 \quad = \quad 1178420166015625 \end{array}$$

$$\begin{array}{r}
 \text{5.} \\
 1283918464548864(144 \text{ Ans.}) \\
 \hline
 1 \\
 1^6 \times 7 = \quad 7)118 \\
 14^7 = \quad \underline{105413504} \\
 14^6 \times 7 = 52706752) \underline{229783424} \\
 144^7 = \quad \underline{1283918464548864}
 \end{array}$$

$$\begin{array}{r}
 \text{6.} \\
 218340105584896(62 \text{ Ans.}) \\
 \hline
 6^8 = \quad 1679616 \\
 6^7 \times 8 = 2239488) \underline{5037850} \\
 62^8 = \quad \underline{218340105584896}
 \end{array}$$

SECTION LXIII.

ARITHMETICAL PROGRESSION.

2. (p. 258.) $\frac{45 - 5}{11 - 1} = 4$ miles, Ans.

3. $\frac{48 - 3}{10 - 1} = 5$ years, Ans.

4. $\frac{39 - 3}{19 - 1} = 2$ years, Ans.

6. $\frac{51 + 7 \times 12}{2} = 348$ miles, Ans.

7. $\frac{39 + 3 \times 19}{2} = 399$ years, Ans.

8. $320 \times 30 = 9600 =$ rods in 30 miles ; but there will be one more stone in this distance than there are rods, because there will be a stone at each end of the 30 miles. The man must travel 2 rods to bring the first stone to the basket, and

60 miles and 2 rods to bring the last stone ; wherefore the following formula :—

$$\frac{19202 + 2 \times 9601}{2} = 92188802 \text{rd.} = 288090 \text{ miles } 2 \text{ rods,}$$

[Ans.]

10. $\frac{39 - 3}{2} + 1 = 19$ scholars, Ans.

11. $\frac{51 - 7}{4} + 1 = 12$ days, Ans.

12. $\frac{45 + 3 \times 45 - 3 + 2}{2 \times 2} = 528$ sum of the series, Ans.

13. $\frac{618 + 6 \times 618 - 6 + 12}{2 \times 12} = \$ 162.24$ Ans.

14. $\frac{528 \times 2}{3 + 45} = 22$; $\frac{45 - 3}{22 - 1} = 2$ common difference, Ans.

15. $\frac{528 \times 2}{22} - 3 = \$ 45$; $\frac{45 - 3}{22 - 1} = \$ 2$ difference, Ans.

SECTION LXIV.

GEOMETRICAL SERIES,

OR SERIES BY QUOTIENT.

3. (p. 264.) $\frac{72}{3^{6-1}} = \$ 7$ first term, Ans.

4. $2 \times 2^{30-1} = \$ 10737418.24$ Ans.

5. $5 \times 3^{7-1} = 3645$ seventh term, Ans.

6. $50 \times 1.06^{6-1} = 63.123848$ last term, Ans.

7. $\$ 160 \times 1.06^{7-1} = \$ 226.96305796096$ Ans.

8. $\$ 300 \times 1.05^{4-1} = \$ 443.236+$ Ans.

9. $\$ 100 \times 1.06^{31-1} = \$ 574.34,91172913250116264106-332310802645846357252196069357387776$ Ans.

13. $\frac{10^{12} - 1}{10 - 1} \times 1 = \111111111111 Ans.

14. $\frac{2^{40} - 1}{2 - 1} \times 10 = \109951162777.50 Ans.

15. $\frac{1.06^4 - 1}{1.06 - 1} \times 50 = 218.7308$ sum of the series, Ans.

16. By examining this question, we find there have been 21 deposits. The amount of the last deposit is \$10.60, the \$10 being on interest only one year. The last but one is \$11.23.6. The last but two is \$11.91,016. The last but three is \$12.62,47696, and so on. Thus we have a regular geometrical series, the ratio of which is 1.06, the first term \$10.60, the number of terms 21, to find the sum of all the series.

$$\frac{1.06^{21} - 1}{1.06 - 1} \times 10.60 = \$423.92,2+$$

Ans.

17. $\frac{1 - (\frac{1}{4})^5}{1 - \frac{1}{4}} \times 7 = 9\frac{83}{256}$ Ans.

18.
$$\begin{array}{cccccccccc} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\ 2 & 4 & 8 & 16 & 32 & 64 & 128 & 256 & 512 & 1024 \end{array}$$

$1024 = 10^{\text{th}}$ power.
 $1024 = 10^{\text{th}}$ do.

12)1836

153 terms; therefore the ratio 2 is to be raised to the 152d power.

$\frac{4096}{1024}$

$\frac{2048}{1024}$

$\frac{1024}{1024}$

$\frac{1048576}{1024} = 20^{\text{th}}$ do.

$\frac{1024}{1024} = 10^{\text{th}}$ do.

$\frac{4194304}{1024}$

$\frac{2097152}{1024}$

$\frac{1048576}{1048576}$

$\frac{1073741824}{1073741824} = 30^{\text{th}}$ do.

$\frac{1073741824}{1073741824} = 30^{\text{th}}$ do.

$\frac{4294967296}{4294967296}$

$\frac{2147483648}{2147483648}$

$\frac{8589934592}{8589934592}$

$\frac{1073741824}{1073741824}$

$\frac{4294967296}{4294967296}$

$\frac{7516192768}{7516192768}$

$\frac{3221225472}{3221225472}$

$\frac{7516192768}{7516192768}$

$\frac{1073741824}{1073741824}$

$\frac{1152921504606846976}{1152921504606846976} = 60^{\text{th}}$ do.

(Carried up.)

(Brought up.)

$$\begin{array}{l} 1152921504606846976 = 60\text{th power.} \\ 1152921504606846976 = 60\text{th do.} \end{array}$$

$$\begin{array}{l} 6917529027641081856 \\ 8070450532247928832 \end{array}$$

$$\begin{array}{l} 10376293541461622784 \\ 6917529027641081856 \end{array}$$

$$\begin{array}{l} 4611686018427387904 \\ 92223372036854775808 \end{array}$$

$$\begin{array}{l} 6917529027641081856 \\ 2305843009213693952 \end{array}$$

$$\begin{array}{l} 6917529027641081856 \\ 4611686018427387904 \end{array}$$

$$\begin{array}{l} 5764607523034234880 \\ 1152921504606846976 \end{array}$$

$$\begin{array}{l} 2305843009213693952 \\ 1152921504606846976 \end{array}$$

$$\begin{array}{l} 10376293541461622784 \\ 2305843009213693952 \end{array}$$

$$\begin{array}{l} 5764607523034234880 \\ 1152921504606846976 \end{array}$$

$$\begin{array}{l} 1152921504606846976 \\ 1152921504606846976 \end{array}$$

$$1048576 = 20\text{th p.}$$

$$4 = 2\text{d p.}$$

$$4194304 = 22\text{d p.}$$

$$4194304 = 22\text{d do.}$$

$$1339227995784915872903807060280344576 = 120\text{th power.}$$

$$4194304 = 22\text{d do.}$$

$$5316911983139663491615228241121378304$$

$$3987683967354747618711421180841033728$$

$$5316911983139663491615228241121378304$$

$$11963051962064242886134263542523101184$$

$$1329227995784915872903807060280344576$$

$$5316911983139663491615228241121378304$$

$$\begin{array}{l} 5575186299632555785383929568162090376495104 = 142\text{d} \\ \qquad\qquad\qquad 1024 = 10\text{th} \end{array} \quad \begin{array}{l} \text{do.} \\ \text{do.} \end{array}$$

$$22300745198530623141535718272648361505980416$$

$$1115037259926531157076859136324180752990208$$

$$5575186299632555785383929568162090376495104$$

$$5708990770823839524233143877797980545530986.496 = 152\text{d} \quad \begin{array}{l} \text{do.} \\ .001 \end{array}$$

$$5708990770823839524233143877797980545530986.496 = \text{last term.}$$

$$2 = \text{ratio.}$$

$$\$11417981541647679048466287755595961091061972.992 - 1\text{ m.}$$

Dividing by the ratio less 1 does not alter it; so that the above is the true answer.

$$20. \frac{100 \times 100 + 1 \times 200 + 1}{6} = 336350 \text{ Ans.}$$

$$21. \frac{50 \times 50 + 1 \times 100 + 1}{6} = 42925 \text{ Ans.}$$

$$22. \frac{80 \times 80 + 1 \times 160 + 1}{6} = 173880 \text{ Ans.}$$

$$24. \overline{10 + 1}^2 \times 5 = 3025 \text{ Ans.}$$

$$25. \overline{50 + 1}^2 \times 25 = 1625625 \text{ Ans.}$$

SECTION LXV.

INFINITE SERIES.

$$2. (p. 268.) \frac{5 \times 5}{4} = 6\frac{1}{4} \text{ Ans.} \quad | \quad 5. \frac{11 \times 7}{7 - 1} = 12\frac{5}{6} \text{ Ans.}$$

$$3. \frac{8 \times 7}{7 - 1} = 9\frac{1}{3} \text{ Ans.}$$

$$4. \frac{1 \times 3}{3 - 1} = 1\frac{1}{2} \text{ Ans.}$$

$$6. \frac{\frac{3}{2} \times 2}{2 - 1} = 1\frac{1}{3} \text{ Ans.}$$

SECTION LXVI.

DISCOUNT BY COMPOUND INTEREST.

$$2. (p. 268.) 1.06^4 = 1.26247696 \times \$500.00 (\$396.04,6+) \text{ Ans.}$$

$$3. 1.05^{10} = 1.628894 \times \$1000.00,0 (\$613.91,3+) \text{ Ans.}$$

$$4. 1.06^9 = 1.1236 \times \$800.00,0 (\$711.99,7+)$$

$$\quad \quad \quad \$800.00,0 - \$711.99,7+ = \$88.00,3 \text{ Ans.}$$

$$5. \quad \$1291.26 \quad | \quad 6. \quad \$1428.52 \quad | \quad 7. \quad \$6349.21$$

SECTION LXVII.

ANNUITIES AT COMPOUND INTEREST.

$$2. (p. 269.) \frac{1.06^5 - 1}{1.06 - 1} \times \$500 = \$2818.54,6+ \text{ Ans.}$$

3. $\frac{1.06^{10} - 1}{1.06 - 1} \times \$1000 = \$13180.79,4+$ Ans.

4. $\frac{1.06^8 - 1}{1.06 - 1} \times \$30 = \$95.50,8+$ Ans.

7. $\frac{1.06^{10} - 1}{1.06 - 1} \times \$500 = \$6590.39,75$ amount of an annuity of \$500 for 10 years; therefore

$$1.06^{10} = 1.7908476) \$6590.39,75 (\$3680.04+$$
 Ans.

8. By Table II. the present worth of an annuity of \$1 for 10 years is \$7.360087; then the present worth of \$1000 is \$7.360087 \times 1000 = \$7360.08 Ans.

9. By Table II. the present worth of an annuity of \$1 for 3 years is \$2.673012; the present worth of \$1728 is \$2.673012 \times 1728 = \$4618.96 Ans.

10. $\frac{1.05^7 - 1}{1.05 - 1} \times \$200 = \$1628.40,169+$ amount of an annuity of \$200 for 7 years at 5 per cent. To find the present worth of this sum, we divide it by the amount of \$1 for the given rate and time. Thus the amount of \$1 is \$1.05^7 = \$1.4071+; therefore

$$\$1.4071) \$1628.40,169 (\$1157.27+$$
 Ans.

Or, \$1.4071 : \$1.00 :: \$1628.40,169 : \$1157.27+ Ans.

11. $\frac{1.06^8 - 1}{1.06 - 1} \times 300 = \$2969.23,9+$ amount of \$300 for 8 years. $1.06^8 = \$1.593848+$ amount of \$1 for 8 years. \$1.593848 : \$1.00 :: \$2969.23,9 : \$1862.93,8 Ans.

12. $\frac{1.06^9 - 1}{1.06 - 1} \times \$100 = \$1149.13,16+$ amount of \$100 for 9 years. $1.06^9 = \$1.689478959$ amount of \$1 for 9 years. \$1.689478959 : \$1.00 :: \$1149.13,16+ : \$680.16,9+ Ans.

15. By Table I. the amount of \$1 for 25 years is \$47.727099; therefore \$800 will amount to \$800 \times \$47.727099 = \$38181.67,9+ Ans.

16. By Table I. the amount of \$1 for 30 years is

$\$79.058186$; therefore the amount of $\$40$ is $\$40 \times \$79.058186 = \$3162.32,7+$ Ans.

17. By Table II. the present worth of an annuity of $\$1$ for 40 years is $\$15.046297$; therefore the present worth of $\$500$ is $\$500 \times \$15.046297 = \$7523.14,8+$ Ans.

18. By Table I. the amount of $\$1$ for 6 years is $\$6.975319$; the amount, therefore, of $\$700$ is $\$700 \times \$6.975319 = \$4882.72,3+$ Ans.

SECTION LXIX.

ALLIGATION.

2. (p. 276)

$$\begin{array}{rcl} 19\text{bu. at } \$1.00 & = & \$19.00 \\ 40\text{bu. at } .66 & = & 26.40 \\ 11\text{bu. at } .50 & = & 5.50 \\ \hline 70\text{bu.} & : & \$50.90 :: 1\text{bu.} : \$0.72,7+ \text{ Ans.} \end{array}$$

3.

$$\begin{array}{rcl} 3\text{lb. at 22 carats} & = & 66 \text{ carats.} \\ 3\text{lb. at 20 carats} & = & 60 \text{ carats.} \end{array}$$

$$6\text{lb.} : 126 \text{ carats} :: 1\text{lb.} : 21 \text{ carats, Ans.}$$

$$\begin{array}{rcl} 20\text{lb. at } \$0.70 & = & \$14.00 \\ 15\text{lb. at } .60 & = & 9.00 \\ 80\text{lb. at } .40 & = & 32.00 \\ \hline 115\text{lb.} & : & \$55.00 :: 1\text{lb.} : \$0.47\frac{1}{2} \text{ Ans.} \end{array}$$

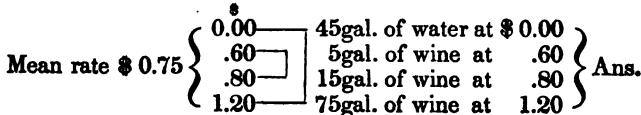
6.

Mean rate $\$0.80$	$\left\{ \begin{array}{c} \$0.50 \\ .75 \\ 1.00 \end{array} \right.$	$\left \begin{array}{c} 20 \\ 20 \\ 30 + 5 \end{array} \right.$	$\left \begin{array}{c} 20 \text{ at } \$0.50 \\ 20 \text{ at } .75 \\ 35 \text{ at } 1.00 \end{array} \right. \right\} \text{ Ans.}$
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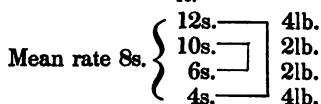
7.

Mean rate 20 carats	$\left\{ \begin{array}{c} 15 \\ 19 \\ 23 \\ 24 \end{array} \right.$	$\left \begin{array}{c} \text{carats.} \\ 4\text{oz. of 15 carats,} \\ 3\text{oz. of 19 carats,} \\ 1\text{oz. of 23 carats,} \\ 5\text{oz. of 24 carats,} \end{array} \right. \right\} \text{ Ans.}$
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8.

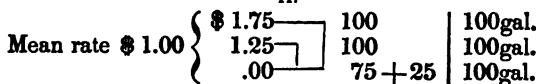


10.



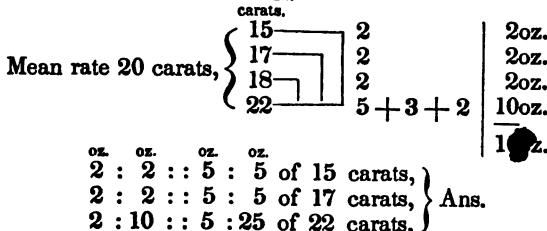
$$\begin{array}{l} 4\text{lb. : } 2\text{lb. :: } 20\text{lb. : } 10\text{lb. at } 6\text{s.} \\ 4\text{lb. : } 2\text{lb. :: } 20\text{lb. : } 10\text{lb. at } 10\text{s.} \\ 4\text{lb. : } 4\text{lb. :: } 20\text{lb. : } 20\text{lb. at } 12\text{s.} \end{array} \left. \right\} \text{Ans.}$$

11.



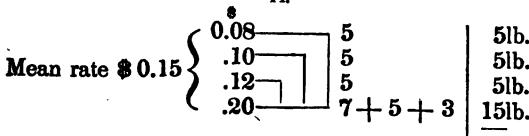
$$\begin{array}{l} 100\text{gal. : } 100\text{gal. :: } 20\text{gal. : } 20\text{gal. port wine,} \\ 100\text{gal. : } 100\text{gal. :: } 20\text{gal. : } 20\text{gal. temperance wine,} \end{array} \left. \right\} \text{Ans.}$$

12.



$$\begin{array}{l} \text{or } \frac{\text{oz.}}{2} : \frac{\text{oz.}}{2} : : \frac{\text{oz.}}{5} : \frac{\text{oz.}}{5} \text{ of } 15 \text{ carats,} \\ \frac{\text{oz.}}{2} : \frac{\text{oz.}}{2} : : \frac{\text{oz.}}{5} : \frac{\text{oz.}}{5} \text{ of } 17 \text{ carats,} \\ \frac{\text{oz.}}{2} : \frac{\text{oz.}}{10} : : \frac{\text{oz.}}{5} : \frac{\text{oz.}}{25} \text{ of } 22 \text{ carats,} \end{array} \left. \right\} \text{Ans.}$$

14.



$$\begin{array}{l} \text{lb. lb. lb. lb.} \\ 30 : 200 : : 5 : 33\frac{1}{3} \text{ at } 8\text{cts.} \\ 30 : 200 : : 5 : 33\frac{1}{3} \text{ at } 10\text{cts.} \\ 30 : 200 : : 5 : 33\frac{1}{3} \text{ at } 12\text{cts.} \\ 30 : 200 : : 15 : 100 \text{ at } 20\text{cts.} \end{array} \left. \right\} \text{Ans.}$$

SECTION LXX.

PERMUTATIONS AND COMBINATIONS.

2. (p. 280.) $1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 \times 9 \times 10 = 3628800$ days, Ans.
3. $1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 \times 9 \times 10 \times 11 \times 12 = 479001600$ changes. $365d. 5h. 49m. = 525949$ minutes; $479001600 \div 10 = 47900160$ minutes; $47900160 \div 525949 = 91y. 38801m. = 91y. 26d. 22h. 41m.$ Ans.
4. $1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 \times 9 \times 10 \times 11 \times 12 \times 13 \times 14 \times 15 \times 16 \times 17 \times 18 \times 19 \times 20 \times 21 \times 22 \times 23 \times 24 \times 25 \times 26 = 40329146112660563-5584000000$ changes, Ans.
6. $26 \times 25 \times 24 \times 23 \times 22 \times 21 = 165765600$ words, Ans.
10. $6 \times 8 \times 9 \times 9 = 3888$ choices, Ans.
11. $6 \times 6 \times 6 \times 6 \times 6 = 7776$ changes, Ans.

SECTION LXXI.

LIFE INSURANCE.

3. (p. 285.) $\$78.00 \times .0497 = \3876.60 Ans.
4. $\$2000 \times .0088 = \17.60 Ans.
5. $\$12,000 \times .0373 = \447.60 ; $\$447.60 \times 3 = \1342.80 ; $\$12,000 - \$1342.80 = \$10,657.20$ Ans.
6. As Swan died when he was 60 years old, his life was insured 40 years. The amount of an annuity of $\$1$ for 40 years is $\$154.761966$. (See National Arithmetic, page 271.) The insurance for $\$10,000$ for one year is $\$10,000 \times .0177 = \177 ; and the amount of the annuity of $\$177$ for 40 years is $\$154.761966 \times 177 = \$27,392.86$. From this we subtract the sum which the Company pays to the heirs of Swan, $\$27,392.86 - \$10,000 = \$17,392.86$ Ans.

SECTION LXXII.

SINGLE POSITION.

2. (p. 286.) By ANALYSIS.—If $\frac{1}{3}$ and $\frac{1}{4}$ of any number be taken, $\frac{5}{12}$ will remain; and if 60 be $\frac{1}{12}$ of a number, 12 will be $\frac{1}{5}$; and if 12 be $\frac{1}{12}$, 12 twelfths will be 144, Ans.

3. By ANALYSIS.—If any number be increased $\frac{1}{2}$, $\frac{1}{3}$, and $\frac{1}{4}$ of itself, the number will be $2\frac{1}{12}$, or $\frac{29}{12}$ of itself; and if $\frac{29}{12}$ of a number be 125, $\frac{1}{12}$ will be 5, and $\frac{1}{3}$ will be 60, Ans.

4. By ANALYSIS.—B's age is $\frac{1}{2}$ of A's, and C's age is $\frac{1}{3}$ of $\frac{1}{2} = \frac{1}{4}$ of A's. These fractions, then, $\frac{1}{2}$, $\frac{1}{4}$, and $\frac{1}{3}$, will express the relative proportion of their ages. The sum of these numbers is $\frac{1}{2} + \frac{1}{4} + \frac{1}{3} = \frac{13}{12}$. If $\frac{13}{12}$ be 140, $\frac{1}{2}$ will be 84 = A's age; B's age will therefore be $\frac{1}{4}$ of 84 = 21; C's age will be $\frac{1}{3}$ of 21 = 7 Ans.

5. By ANALYSIS.—Any sum, at 6 per cent. simple interest, will, in 10 years, amount to $1\frac{3}{5}$ of itself; thus, $\$100 \times .06 = \6 ; $6 \times 10 = \$60$; $60 + 100 = \$160$; $\frac{160}{100} = 1\frac{3}{5} = \frac{8}{5}$; and if $\$560$ be $\frac{8}{5}$, $\$70$ will be $\frac{1}{5}$, and $\frac{1}{5}$ will be $\$350$ Ans.

6. By ANALYSIS.— $\frac{1}{5}$ of any number is $\frac{2}{5}$ more than $\frac{1}{5}$ of it; thus, $\frac{1}{5} - \frac{1}{5} = \frac{2}{5}$; and if $\frac{2}{5}$ be 81, $\frac{1}{5}$ will be $\frac{2}{5}$, and $\frac{1}{5}$ will be $\frac{2}{5} \times 40 = \frac{80}{5} = 16$ Ans.

7. By ANALYSIS.—The difference between $\frac{3}{5}$ and $\frac{4}{5}$ is $\frac{1}{5}$; and if $\frac{1}{5}$ of a number be $2\frac{1}{5} = \frac{11}{5}$, the whole number, or $\frac{5}{5}$, will be $\frac{11}{5} \times 5 = 11$ Ans.

DOUBLE POSITION.

2. (p. 288.) First suppose each laid out $\$500$; then

4) \$500	\$ 500
125	225
<hr/> 625 = A's money.	<hr/> 275 = B's money.

Then, by the question, $2 \times 275 = \$550$ should be A's money, but A's money is $\$625$; therefore $\$625 - \$550 = \$75$ is the first error.

Again, we suppose each laid out $\$800$; then

$$\begin{array}{r} 4) \$800 \\ \quad 200 \\ \hline 1000 = \text{A's money.} \end{array} \qquad \begin{array}{r} \$800 \\ \quad 225 \\ \hline 575 = \text{B's money.} \end{array}$$

Then, by the question, $2 \times \$575 = \1150 should be A's money, but A's money is $\$1000$; therefore $\$1150 - \$1000 = \$150+$ second error.

OPERATION.

$$\begin{array}{r} 500 \times 75 = \text{first error.} \\ 800 \times 150 = \text{second error.} \\ 75 \quad 500 \\ \hline 60000 \quad 75000 \\ \hline 60000 \\ 75 + 150 = 225) 135000 (\$600 \text{ Ans.} \\ \hline 1350 \\ \hline 00 \end{array}$$

BY ANALYSIS.—A having gained a sum equal to $\frac{1}{4}$ of his stock, his present stock will be $\frac{3}{4}$ of his original stock. B having lost $\$225$, and his present stock being $\frac{1}{2}$ of A's, that is, $\frac{1}{2}$ of $\frac{3}{4}$ = $\frac{3}{8}$ of what he had at first, it will therefore follow that $\$225$ is $\frac{5}{8} - \frac{3}{8} = \frac{2}{8}$ of B's original stock. And if $\frac{2}{8}$ be $\$225$, $\frac{1}{8}$ is $\$75$; and if $\frac{3}{8}$ be $\$75$, $\frac{9}{8}$, or the whole stock, will be $8 \times \$75 = \600 Ans.

3. We first suppose the age of the youngest to be 10. Then, by the question, the age of the next older will be 14, and the next 18, and the oldest will be 22. But, by the supposition, the age of the oldest was twice the age of the youngest, that is, $2 \times 10 = 20$; but the age of the oldest is 22; therefore the first error is $22 - 20 = 2$ —too small.

Again, we suppose the age of the youngest to be 16. Then the age of the next older will be 20, and the age of the next

24, and the age of the oldest will be 28. But, by the supposition, the age of the oldest was twice the age of the youngest, that is, $2 \times 16 = 32$; but the age of the oldest is 28; therefore the second error is $32 - 28 = 4$ —too large.

OPERATION.

$$\begin{array}{r} \text{First supposition, } 10 \times 2 = \text{first error.} \\ \text{Second supposition, } 16 \times 4 = \text{second error.} \\ \hline 2 & 10 \\ \hline 32 & 40 \\ & 32 \\ \hline \end{array}$$

$2 + 4 = 6$) 72 (12 years, the age of the
 youngest.

If the youngest be 12, the next older will be 16, and the next older will be 20, and the oldest will be 24. And as the oldest is to be twice the age of the youngest, and as 24 is twice 12, we infer our answer is correct.

BY ANALYSIS.—It appears that his oldest son was 12 years older than the youngest, and that the oldest was also twice as old as the youngest; the oldest must therefore be 24 years old, and the youngest 12; the second son being 4 years younger than the first, and the third being 4 years older than the youngest, their ages will be 20 and 16, Ans.

4. We suppose the value of the first horse to be \$ 20. Then $20 + 50 = \$ 70$ will be twice the value of the second horse, that is, the value of the second horse will be \$ 35. Then, by the question, $35 + 50 = \$ 85$ will be three times the value of the first horse, that is, the first horse will be worth \$ $28\frac{1}{3}$. But, by the supposition, he should be worth but \$ 20; therefore $28\frac{1}{3} - 20 = \$ 8\frac{1}{3}$ —is the first error. Again, we suppose the value of the first horse to be \$ 32. Then $32 + 50 = \$ 82$ will be twice the value of the second horse, that is, the second horse will be worth \$ 41. Then, by the question, $41 + 50 = \$ 91$ will be three times the value of the first horse, that is, the first horse will be worth \$ $30\frac{1}{3}$. But, by

the supposition, he should be worth \$ 32; therefore $32 - 30\frac{1}{2}$
 $= \$ 1\frac{1}{2} +$ is the second error.

OPERATION.

First supposition, $20 \times 8\frac{1}{2}$ first error.
 Second supposition, $32 \times 1\frac{1}{2} +$ second error.

$$\begin{array}{r} 8\frac{1}{2} \quad 20 \\ \hline 266\frac{1}{2} \quad 33\frac{1}{2} \\ \hline 33\frac{1}{2} \end{array}$$

$$8\frac{1}{2} + 1\frac{1}{2} = 10 \quad 300 \quad (\$ 30, \text{ value of the first horse.})$$

$$\begin{array}{r} 30 \\ \hline 0 \end{array} \quad \$ 30 + \$ 50 = \$ 80 \div 2 = \$ 40, \text{ the}$$

[value of the second horse.]

BY ANALYSIS.—It appears by the question, that, if the saddle be put on the first horse, the horse and saddle will be twice the value of the second horse; that is, the first horse will be equal to twice the value of the second horse minus the saddle. Again, if the saddle be put on the second horse, the second horse and the saddle will be equal to three times the value of the first horse; that is, three times the value of the first horse is equal to the value of the second horse plus the saddle. We have before shown, that the value of the first horse is equal to twice the value of the second horse minus the saddle; therefore, by adding these quantities, we find that four times the value of the first horse is equal to three times the value of the second horse. Again, as the first horse and saddle were worth twice the second horse, it will follow, that the saddle is worth twice the second horse minus the first horse; that is, the saddle is worth twice the second horse minus three fourths the second horse, because we have before shown that the first horse is three fourths the value of the second horse; therefore the saddle is worth five fourths of the second horse; but the saddle is worth \$ 50; and if five fourths of the second horse is worth \$ 50, one fourth is worth \$ 10, and four fourths, that is, the whole value of the second horse, will be \$ 40; and, as we have before shown that the first

horse is worth three fourths of the second horse, his value will therefore be \$ 30 Ans.

5. If we suppose the time to be 3 o'clock, it will be 9 hours to midnight, and $\frac{2}{3}$ of 3 hours will be equal to $\frac{2}{3} \times 3 = \frac{6}{3} = 2$ hours, and $\frac{8}{3}$ of 9 hours is $\frac{8}{3} \times \frac{9}{1} = \frac{72}{3} = 24$ hours; therefore the first error will be $24 - 2 = 22$. Again, we suppose the time to be 4 o'clock. Then the time to midnight will be 8 hours; therefore, by the question, $\frac{2}{3}$ of 4 hours will be equal to $\frac{2}{3} \times \frac{4}{1} = \frac{8}{3}$ hours, and $\frac{8}{3}$ of 8 hours is $\frac{8}{3} \times \frac{8}{1} = \frac{64}{3} = 1\frac{31}{3}$ hours; therefore, the second error will be $24 - 1\frac{31}{3} = \frac{8}{3}$.

OPERATION.

First supposition $3 \times \frac{2}{1} = 6$ When the errors are fractions, and have a common denominator, their numerators
 Second supposition $4 \times \frac{2}{1} = 8$ may be used in the operation

$$\begin{array}{r} 2 \\ 8 \\ \hline 24 \end{array}$$
 as if they were whole numbers;

$2 + 8 = 10$) 32 (3h. 12m. bers; because their value is

$$\begin{array}{r} 30 \\ \hline 2 \\ 60 \end{array}$$
 [Ans. as their numerators.

$$\begin{array}{r} 10)120(12 \\ \underline{10} \\ 20 \\ \underline{20} \end{array}$$

BY ANALYSIS.— Reducing $\frac{2}{3}$ and $\frac{8}{3}$ to a common denominator, the fractions will be $\frac{4}{6}$ and $\frac{8}{6}$; therefore $\frac{4}{6}$ of the time past from noon will be equal to $\frac{2}{2}$ of the time to midnight. Divide 12 hours into two parts, in the proportion of 8 to 22, and the first part will be the time from noon; thus, $8 + 22 = 30 : 8 :: 12h. : 3h. 12m.$ Ans.

6. We first suppose their income to be \$ 360 each. Then, as A saves $\frac{1}{2}$ of his income, he will spend $\$ 360 - \$ 180 = \$ 180$; $\$ 360 - \$ 30 = \$ 330$ annually. As B spends \$ 100 per annum more than A, he will spend $\$ 330 + \$ 100 =$

\$ 430 each year; and in 10 years he will spend $10 \times \$ 430 = \$ 4300$. As his income, by the supposition, is only \$ 360 per annum, it would be in 10 years $10 \times \$ 360 = \$ 3600$. His debt would therefore be $\$ 4300 - 3600 = \$ 700$. But by the question it was only \$ 600; therefore the first error will be $\$ 700 - \$ 600 = \$ 100$ —too small.

Again we suppose their income to be \$ 300 annually. Then as A saves $\frac{1}{12}$ of his, he will spend $\$ 300 \div 12 = \$ 25$; $\$ 300 - \$ 25 = \$ 275$ annually; and B, by the question, will spend $\$ 275 + \$ 100 = \$ 375$, and in 10 years he will spend $10 \times \$ 375 = \$ 3750$. B's income by the question will be only $10 \times \$ 300 = \$ 3000$; therefore his debt will be $\$ 3750 - \$ 3000 = \$ 750$. But, by the question, it was only \$ 600, therefore the second error will be $\$ 750 - \$ 600 = \$ 150$ —too small.

OPERATION.

$$\begin{array}{r} \text{First supposition } 360 \\ \text{Second supposition } 300 \\ \hline 100 & 360 \\ \hline 30000 & 9000 \\ & 45 \\ & \hline 54000 \\ & 30000 \\ \hline \end{array}$$

$$\begin{array}{r} 150 - 100 = 50 \\ 240000 (\$ 480, \text{income of each, Ans.}) \\ 200 \\ \hline 400 \\ 400 \\ \hline 0 \end{array}$$

BY ANALYSIS.—If A saves $\frac{1}{12}$ of his income, he spends $\frac{11}{12}$ of it. If B in 10 years spends \$ 600 more than his income, he must expend each year \$ 60 more than his income. And as B spends \$ 100 yearly more than A, it is evident A will save \$ 40 per annum; and as A spends $\frac{11}{12}$, \$ 40 must be $\frac{1}{12}$ of his income; therefore his whole income will be 12 times \$ 40 = \$ 480 Ans.

7. **BY THE RULE OF POSITION.**—It appears by the tenor of the question, that 90 must be so divided into two parts, that, if the larger part be multiplied by 60, and the smaller part by 80, the difference of the products shall be 3300. We therefore suppose the larger part to be 60, and the smaller part 30; and proceed according to the rule, thus: $60 \times 60 = 3600$; $30 \times 80 = 2400$. The difference between these products is $3600 - 2400 = 1200$, which is $3300 - 1200 = 2100$ less than it should be. Again, we divide 90 into the two parts, 80 and 10, and multiply them by 60 and 80 as before, and find the result as follows; $80 \times 60 = 4800$; $10 \times 80 = 800$; $4800 - 800 = 4000$, which is $4000 - 3300 = 700$ more than it should be. We then proceed by the rule, thus: $60 \times 700 = 42000$; $80 \times 2100 = 168000$; $42000 + 168000 = 210000$ sum of the products; $2100 + 700 = 2800$ sum of the errors; $210000 \div 2800 = 75$ = larger number; and $90 - 75 = 15$ smaller number. Therefore we find he labored 75 days, and was idle 15 days, Ans.

8. Assume 300 pounds to be growing on each acre (any other number would answer as well); then $3\frac{1}{2}$ acres will contain 1000 pounds. We now suppose the weekly increase to be 9 pounds; then $3\frac{1}{2}$ acres will, in four weeks, produce 120 pounds.

$$\begin{array}{r} 3\frac{1}{2} \times 300 = 1000 \\ 9 \times 3\frac{1}{2} \times 4 = \underline{120} \end{array}$$

Amount of $3\frac{1}{2}$ acres in 4 weeks = 1120lbs.

Having found that 12 oxen will eat 1120 pounds of grass in 4 weeks, we wish to know how many pounds 21 oxen would eat in 9 weeks, which, by the following process, we find to be 4410 pounds. Thus,

$$\begin{array}{r} 12 : 21 \\ 4 : 9 \end{array} \} :: 1120 : 4410 \text{lbs.}$$

But we find the amount of the grass of 10 acres in 9 weeks to be 3810 pounds. Thus,

$$\begin{array}{r} 300 \times 10 = 3000 \\ 9 \times 10 \times 9 = \underline{810} \\ 3810 \text{ lbs.} \end{array}$$

But, by the supposition, 21 oxen in 9 weeks would eat 4410 lbs.
The first error will therefore be —600

We next suppose the weekly increase to be 18 pounds per acre; therefore, the amount of the grass of $3\frac{1}{2}$ acres in 4 weeks will be 1240 pounds. Thus,

$$\begin{array}{r} 300 \times 3\frac{1}{2} = 1000 \\ 18 \times 3\frac{1}{2} \times 4 = \underline{240} \\ 1240 \text{ lbs.} \end{array}$$

And the amount of 10 acres in 9 weeks would be 4620 lbs.
Thus,

$$\begin{array}{r} 10 \times 300 = 3000 \\ 10 \times 18 \times 9 = \underline{1620} \\ 4620 \text{ lbs.} \end{array}$$

But, by the last supposition, we find that 21 oxen in 9 weeks would eat 4882½ pounds. Thus,

$$12 : 21 \left. \begin{array}{l} \\ 4 : 9 \end{array} \right\} :: 1240 : 4882\frac{1}{2} \text{ lbs.}$$

By subtracting 4620 from 4882½ pounds, we find 4882½
the second error to be —262½. 4620
—262½

OPERATION.

First supposition 9 600 — first error.
Second supposition 18 \times 262½ — second error.

$$\begin{array}{r} 600 \quad 9 \\ 600 \quad 10800 \quad \underline{2362\frac{1}{2}} \\ 262\frac{1}{2} \quad \underline{2362\frac{1}{2}} \\ 337\frac{1}{2} \quad) \quad 8437\frac{1}{2} \text{ (25 lbs. weekly increase.)} \\ \underline{8437\frac{1}{2}} \end{array}$$

Having assumed 300 pounds to the acre, and found the weekly increase to be 25 pounds to the acre, which is $8\frac{1}{2}$ per

cent., we now proceed to find the amount of the produce of 24 acres for 18 weeks. Thus,

$$24 \times 300 = 7200$$

$$25 \times 18 \times 24 = \underline{10800}$$

$$\text{Amount of 24 acres for 18 weeks} = 18000 \text{ lbs.}$$

$$3\frac{1}{2} \times 300 = 1000$$

$$3\frac{1}{2} \times 4 \times 25 = \underline{333\frac{1}{2}}$$

$$\text{Actual amount of } 3\frac{1}{2} \text{ acres for 4 weeks} = 1333\frac{1}{2} \text{ lbs.}$$

The question now is, If 12 oxen eat 1333 $\frac{1}{2}$ pounds of grass in 4 weeks, how many oxen will eat 18000 pounds in 18 weeks? Then,

$$\left. \begin{array}{l} 1333\frac{1}{2} \text{ lbs.} : 18000 \text{ lbs.} \\ 18 \text{ weeks} : 4 \text{ weeks} \end{array} \right\} : : 12 : 36 \text{ oxen, Ans.}$$

9. As the head and tail of the fish weigh 30lb. and $\frac{1}{6}$ of the body; and as the body weighs as much as the head and tail, it is evident that 30lb. is $\frac{1}{6}$ of half the weight of the fish, and 30lb. is $\frac{1}{6}$ of 36lb.; therefore the head and tail weigh 36lb. The body also must weigh 36lb., because, by the question, it weighs as much as the head and tail both; therefore the whole weight of the fish will be $36 + 36 = 72$ lb. Ans.

10. OPERATIONS.

(1.) We first suppose the time to be $60\frac{1}{2}$ seconds after 12 o'clock. The hour-hand then will have passed $\frac{60\frac{1}{2}}{43200}$ of the distance from 12 to 12 again, and the second-hand will have passed once round and $\frac{1}{120}$ of another time. The difference between these two numbers is $\frac{1}{120} - \frac{60\frac{1}{2}}{43200} = \frac{59\frac{1}{2}}{86400}$. The minute-hand will have passed $\frac{60}{3600}$ of the distance from 12, and the difference between this number and $\frac{1}{120}$ is $\frac{60}{3600} - \frac{1}{120} = \frac{71}{86400}$. We now find the difference between this last number and $\frac{59\frac{1}{2}}{86400}$; $\frac{71}{86400} - \frac{59\frac{1}{2}}{86400} = \frac{13\frac{1}{2}}{86400}$ —first error, too small.

We next suppose the time to be 61 seconds after 12 o'clock. The hour-hand then will have passed $\frac{61}{43200}$ of the distance from 12 to 12, and the second-hand will have passed round

and $\frac{1}{60}$ of another time. The difference of these two numbers is $\frac{1}{60} - \frac{61}{43200} = \frac{60}{43200}$. We now find the difference between the second-hand and minute-hand. The minute-hand has moved in 61 seconds $\frac{61}{3600}$ of the distance from 12 to 12, the difference between $\frac{61}{3600} - \frac{1}{60} = \frac{12}{43200}$. We next find the difference between this last number and $\frac{60}{43200}$; $\frac{60}{43200} - \frac{12}{43200} = \frac{48}{43200} = \frac{12}{1100}$ + second error. As the denominators of our errors are the same number, we may reject them in the operation; for when fractions have a common denominator, their values are as their numerators.

First supposition $60.5 - 133$ — first error.

Second supposition $61 - 1294$ + second error.

$$60.5 \times 1294 = 78287; \quad 61 \times 133 = 8113; \quad 133 + 1294 = 1427; \quad 78287 + 8113 = 86400; \quad 86400 \div 1427 = 60\frac{78}{1427}$$

seconds, Ans.

(2.) Suppose the time to be $61\frac{1}{2}$ seconds after 12 o'clock. Then the hour-hand will have moved $\frac{61.5}{43200}$ of the distance from 12 o'clock to 12 again, and the minute-hand will have moved $\frac{61.5}{3600}$ of this distance, and the second-hand will have moved once round and $\frac{1}{60}$ again. The difference between $\frac{61.5}{43200}$ and $\frac{61.5}{3600}$ is $\frac{678.5}{43200}$. The difference between $\frac{1}{60}$ and $\frac{61.5}{3600}$ is $\frac{34.25}{43200}$. We then find the difference between $\frac{678.5}{43200}$ and $\frac{34.25}{43200} = \frac{644.25}{43200}$ — the first error.

We then suppose the time to be 62 seconds after 12 o'clock. The hour-hand will then have moved from 12 o'clock $\frac{62}{43200}$ of the distance to 12 again, and the minute-hand have moved $\frac{62}{3600}$ of the distance, and the second-hand will have gone once round and $\frac{1}{60}$ of the distance again. The difference between $\frac{62}{43200}$ and $\frac{62}{3600}$ is $\frac{682}{43200}$. The difference between $\frac{1}{60}$ and $\frac{62}{3600}$ is $\frac{14}{43200}$. The difference between $\frac{682}{43200}$ and $\frac{14}{43200}$ is $\frac{668}{43200}$ — second error.

First supposition $61.5 - 334.5$ — first error.

Second supposition $62 - 14$ + second error.

$$61.5 \times 14 = 861; \quad 62 \times 334.5 = 20739; \quad 334.5 + 14 = 348.5; \quad 861 + 20739 = 21600; \quad 21600 \div 348.5 = 61\frac{68}{348.5}$$

seconds, Ans.

(3.) We will first suppose the time to be 59 seconds after 12 o'clock; the hour-hand will then have advanced $\frac{59}{13200}$ of the distance from 12 o'clock to 12 again, and the second-hand will be within $\frac{1}{60}$ of the distance to 12; therefore, the whole distance between the hour-hand and the second-hand will be $\frac{1}{60} + \frac{59}{13200} = \frac{118}{13200}$; and the distance between the hour-hand and minute-hand will be $\frac{59}{13200} - \frac{58}{13200} = \frac{1}{13200}$, and the difference between $\frac{118}{13200}$ and $\frac{1}{13200} = \frac{117}{13200}$ —the first error.

Secondly

Again, we will suppose the time to be 58 minutes after 12 o'clock. The distance then between the second-hand and hour-hand will be $\frac{2}{60} + \frac{58}{13200} = \frac{148}{13200}$. The distance between the hour-hand and minute-hand will be $\frac{58}{13200} - \frac{58}{13200} = \frac{0}{13200}$, and $\frac{148}{13200} - \frac{0}{13200} = \frac{148}{13200}$ —will be the second error.

First supposition 59 \times 130—first error.

Second supposition 58 \times 860—second error.

$$59 \times 860 = 50740; 58 \times 130 = 7540; 860 - 130 = 730; \\ 50740 - 7540 = 43200; 43200 \div 730 = 59\frac{1}{3} \text{ seconds, Ans.}$$

SECTION LXXIII.

EXCHANGE.

1. (p. 297.) 9765£. 15s. 6d. = 9765.775£.; 9765.775£. \times 4.84 $\frac{1}{3}$ = \$47,309.75+ Ans.
2. 18761£. 10s. \times 1.08 $\frac{1}{2}$ = 20,356£. 4s. 6 $\frac{1}{4}$ d.+ Ans.
3. \$81,727.75 \div 1.095 = \$74,618.9497; \$74,618.9497 \div 4.44 $\frac{1}{3}$ = 16,789£. 5s. 3 $\frac{1}{4}$ d.+ Ans.
4. 17,000£. \times 1.06 = 18,020£.; 18,020£. \times 4.44 $\frac{1}{3}$ = \$80,088.88+ Ans.
5. 172,000 francs \times 1.01 $\frac{1}{2}$ = 174,580 francs; 174,580 francs \times .18 $\frac{1}{3}$ = \$32,471.88 Ans.
6. 76,000 francs \div 5.08 = \$14,960.62+ Ans.

7. 79,000 francs $\times .98 = 77420$ francs ; 77420 francs $\times .18\frac{3}{4} = \$ 14,400.12+$ Ans.
8. $\$ 17,280 \times 5.10 = 88,128$ francs, Ans.
9. As 20 stivers make 1 florin, 10 stivers make .5 of a florin.
Therefore $896.5 \times .38 = \$ 340.67$ Ans.
10. $\$ 340.67 \div .38 = 896.5 = 896$ florins 10 stivers, Ans.
11. As 40 paras = 1 piaster, 20 paras = .5 piaster. Therefore $78.5 \times .40 = \$ 31.40$ Ans.
12. $\$ 31.40 \div 40 = 78.5 = 78$ piasters 20 paras, Ans.

NOTE. — The pupil will perceive, that, in the work of the following questions, the *inferior* denominations are reduced to a decimal of the *superior* denomination before the operation of the question.

13. $896.5 \times .50 = \$ 448.25$ Ans.
14. 196 rix dollars 2 florins = 590 florins ; $590 \times .17 = \$ 100.30$ Ans.
15. $\$ 100.30 \div .17 = 590$ florins ; $590 \div 3 = 196$ rix dollars 2 florins, Ans.
16. 675 rix dollars 2 marks = 2027 marks ; $2027 \times .30 = \$ 608.10$ Ans.
17. $\$ 608.10 \div .30 = 2027$ marks ; $2027 \div 3 = 675$ rix dollars 2 marks, Ans.
18. $286.5 \times .90 = \$ 257.85$ Ans.
19. $\$ 257.85 \div .90 = 286$ pezze 10 soldi, Ans.
20. $176.5 \times .20 = \$ 35.30$ Ans.
21. $\$ 35.30 \div .20 = 176$ lire 10 soldi, Ans.
22. $769.5 \times .80 = \$ 615.60$ Ans.
23. $\$ 615.60 \div .80 = 769$ ducati di regno 5 carlini, Ans.
24. $876 \times 2.38,3 = \$ 2087.50,8$. As 5 scudi are equal to 2 oncie, 3 scudi are equal to $\frac{3}{5}$ oncia ; therefore $\$ 2.38,3 \times \frac{3}{5} = \$ 2.85,9\frac{3}{4}$; $\$ 2087.50,8 + \$ 2.85,9\frac{3}{4} = \$ 2090.36,7\frac{3}{4}$ Ans.
25. $\$ 2090.36,7\frac{3}{4} \div 2.38,3 = 876$ oncie 3 scudi, Ans.
26. $7684.8 \times .75 = \$ 5763.60$ Ans.
27. $\$ 5763.60 \div .75 = 7684$ rubles 8 grieves, Ans.
28. $7689 \times \$ 1.00,0\frac{67}{100} = \$ 7694.15\frac{163}{1000}$ Ans.

29. $\$7694.15 \frac{163}{1000} \div 1.00,0 \frac{67}{100} = 7689$ scudi moneta, Ans.
 30. $7600 \times .75 = \$5700$ Ans.
 31. $\$5700 \div .75 = 7600$ dollars of plate, Ans.
 32. $476.5 \times 1.07 = \$509.85,5$ Ans.
 33. $\$509.85,5 \div 1.07 = 476$ rix dollars 24 skillings, Ans.
 34. $462.5 \times .20 = \$92.50$ Ans.
 35. $\$92.50 \div .20 = 462$ lire 10 soldi, Ans.
 36. $876.5 \times .97 = \$850.20,5$ Ans.
 37. $\$850.20,5 \div .97 = 876$ rix dollars 1 florin, Ans.
 38. $432.75 \times .50 = \$216.37\frac{1}{2}$ Ans.
 39. $\$216.37,5 \div .50 = 432$ rupees 12 annas, Ans.
 40. $678.5 \times .50 = \$339.25$ Ans.
 41. $\$339.25 \div .50 = 678$ rupees 2 quarters, Ans.
 42. $375 \times 1.77\frac{1}{2} = \$666.66,6\frac{2}{3}$ Ans.
 43. $\$896 + 1.77\frac{1}{2} = 504$ star pagodas, Ans.
 44. $769\frac{1}{2} \times .92 = \$707.88\frac{1}{2}$ Ans.
 45. $\$707.88\frac{1}{2} \div .92 = 769$ rix dollars 40 creutzers, Ans.
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SECTION LXXV.

GEOMETRY.

1. (p. 317.) $15 \times 2 = 30$ feet, Ans.
2. $128 \times 48 = 6144$ miles, Ans.
3. $693 \times 693 = 48049$; $48049 \div 272\frac{1}{4} = 1764$ poles,
 $1764 \div 160 = 11$ A. 0R. 4p. Ans.
4. $40 \times 40 = 1600$ feet; $20 \times 20 \times 2 = 800$ feet; $1600 - 800 = 800$ feet, Ans.
5. $\sqrt{3600} = 60$ yards; $3600 \div 2 = 1800$ yards; $\sqrt{1800} = 42.427+$ yards; 60 yards $- 42.427$ yards $= 17.573$ yards; $17.573 \div 2 = 8.78+$ yards, Ans.
6. $8 \times 12 = 96$ feet, Ans.
7. $12 \times 18 = 216$ feet; $216 \div 2 = 108$ feet, Ans.
8. $15.6 + 9.2 + 10.4 = 35.2$ feet; $35.2 \div 2 = 17.6$ feet;

- $$17.6 - 15.6 = 2.00; \quad 17.6 - 9.2 = 8.4; \quad 17.6 - 10.4 \\ = 7.2; \quad 17.6 \times 2 \times 8.4 \times 7.2 = 2128.896; \quad \checkmark 2128.896 \\ = 46.139+ \text{ feet, Ans.}$$
9. $144 \times 3.141592 = 452.389248$ feet, Ans.
 10. $7964 \times 3.141592 = 25019.638688+$ miles, Ans.
 11. $761 \times 761 \times .785398 = 454840.475158$ feet, Ans.
 12. $320 \times 3 = 960 \times 960 \times .785398 = 7238.227968$ rods;
 $7238.227968 \div 160 = 4523.89+$ acres, Ans.
 13. $50 \times .886227 = 44.31135+$ rods, Ans.
 14. $30 \times .707106 = 21.21+$ inches square, Ans.
 15. $80 \times .707106 = 56.56848+$ feet, Ans.
 16. $80 \times .8660254 = 69.28+$ feet, Ans.
 17. $50 \times .8660254 = 43.3+$ inches, Ans.
 18. $30 \times .8660254 = 25.98+$ inches, Ans.
 19. $25,000 \times .3183098 = 7957.74+$ miles, Ans.
 20. $50 \times .3183098 = 15.91549+$ inches, Ans.
 21. $360 \times .282094 = 101.55+$ rods, Ans.
 22. $10,000 \times .282094 = 2820.94+$ rods, Ans.
 23. $5000 \times .2756646 = 1378.323$ feet, Ans.
 24. $80 \times .2756646 = 22.05+$ inches, Ans.
 25. $5000 \times .225079 = 1125.395+$ rods, Ans.
 26. $100 \times .225079 = 22.5+$ inches square, Ans.
 27. $10 \div .225079 = 44.42+$ inches, Ans.
 28. $18 \div .225079 = 79.97+$ inches, Ans.
 29. $20 \times 16\frac{1}{2} = 330; \quad 330 \div .225079 = 1466.15+$ feet, Ans.
 30. $1\frac{1}{2} \times 1\frac{1}{2} \times 1\frac{1}{2} = 3\frac{3}{8}$ feet, Ans.
 31. $6 \times 2\frac{1}{2} \times 1\frac{1}{2} = 26\frac{1}{4}$ feet, Ans.
 32. $3\frac{1}{8} \times 2\frac{3}{4} \times 2\frac{1}{2} = 21\frac{1}{8}$ feet, Ans.
 33. $2\frac{1}{2} \times 3 = 7\frac{1}{2}; \quad 7\frac{1}{2} \div 2 = 3\frac{3}{4}; \quad 3\frac{3}{4} - 2\frac{1}{2} = 1\frac{1}{4} = \frac{5}{4}; \quad 3\frac{3}{4} \\ = \frac{15}{4}; \quad \frac{15}{4} \times \frac{5}{4} \times \frac{5}{4} \times \frac{5}{4} = \frac{1875}{256} = 7.32421875$ feet;
 $\checkmark 7.32421875 = 2.7063+$ feet; $2.7063 \times 12 = 32.47+$ feet, Ans.
 34. $5 + 4 + 3 = 12; \quad 12 \div 2 = 6$ feet; $6 - 5 = 1; \quad 6 - 4 = 2; \quad 6 - 3 = 3; \quad 6 \times 1 \times 2 \times 3 = 36; \quad \checkmark 36 = 6; \quad 6 \times 10 = 60$ feet, Ans.

35. $2\frac{1}{2} \times 2\frac{1}{2} \times .785398 \times 12\frac{1}{2} = 61.35921875$; $61.35921875 \div 3 = 20.45+$ feet, Ans.
36. $5 + 6 + 7 = 18$; $18 \div 2 = 9$; $9 - 5 = 4$; $9 - 6 = 3$; $9 - 7 = 2$; $9 \times 4 \times 3 \times 2 = 216$; $\sqrt{216} = 14.69693+$; $14.69693 \times 14\frac{1}{2} = 213.105485$; $213.105485 \div 3 = 71.035+$ feet, Ans.
37. $75 \div .785398 = 95.492987$; $95.492987 \div 2 = 47.746493+$ square rods, Ans.
38. $75 + .785398 = 95.492987$; $\sqrt{95.492987} = 9.772+$ rods, Ans.
39. $25 \times 25 = 625$; $625 \div 2 = 312.5$; $625 - 312.5 = 312.5$; $25 \times 25 \times .785398 = 490.87375$; $625 - 490.87375 = 134.12625$; $490.87375 - 312.5 = 178.37375$ Ans.
40. $9 \times 20 = 180$; $180 \div 2 = 90$ feet, Ans.
41. $24 \times 12 = 288$; $12 \times 12 = 144$; $144 \div 3 = 48$; $288 + 48 = 336$; $336 \times .785398 \times 40 = 10555.74912$; $10555.74912 + 144 = 73.303+$ feet, Ans.
42. $12 \times 12 \times 12 \times .5236 = 904.78$ inches, Ans.
43. $25000 \times .31831 = 7957.75$; $7957.75 \times 7957.75 = 63325785.0625$; $63325785.0625 \times 7957.75 = 50393-0766081.109375$; $503930766081.109375 \times .5236 = 263858149120.06886875$ cubic miles, Ans.
44. $24 \times 3.141592 = 75.398208$; $75.398208 \times 24 = 1809.556992$ inches, Ans.
45. $7957.75 \times 25000 = 198943750$ square miles, Ans.
47. $40 \times 40 = 1600$; $1600 \div 3 = 533.3333+$; $\sqrt{533.3333} = 23.09+$ inches, Ans.
48. $20 \times 20 = 400$; $400 \div 3 = 133.3333+$; $\sqrt{133.3333} = 11.547+$; $11.547 \times 11.547 \times 11.547 = 1539.6+$ inches, Ans.

SECTION LXXVI.

GAUGING.

1. (p. 327.) $10\text{ft.} = 120\text{in.}; 5\text{ft.} = 60\text{in.}; 4\text{ft.} = 48\text{in.}; 120 \times 60 \times 48 = 345600; 345600 \div 231 = 1496\frac{8}{7}\text{gal.}$
Ans.
 2. $12\text{ft.} = 144\text{in.}; 6\text{ft.} = 72\text{in.}; 2\text{ft.} = 24\text{in.}; 144 \times 72 \times 24 = 248832\text{in.}; 248832 \div 282 = 882\frac{8}{47}\text{gal.}$ Ans.
 3. $15\text{ft.} = 180\text{in.}; 5\text{ft.} = 60\text{in.}; 7\text{ft.} = 84\text{in.}; 180 \times 60 \times 84 = 907200\text{in.}; 907200 \div 2150.42 = 421.8+\text{bu.}$
Ans.
 5. $40 - 30 = 10; 10 \times .65 = 6.5; 30 + 6.5 = 36.5; 36.5 \times 36.5 = 1332.25; 1332.25 \times 50 = 66612.5; 66612.5 \div 359 = 185.55+\text{gal.}$ Ans.
 6. $40 \times 30 = 1200; 40 - 30 = 10; 10 \times 10 = 100; 100 \div 3 = 33\frac{1}{3}; 1200 + 33\frac{1}{3} = 1233\frac{1}{3}; 1233\frac{1}{3} \times 50 = 61666.66+; 61666.66 \div 294 = 209.7+\text{gal.}$ Ans.
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SECTION LXXVII.

TONNAGE OF VESSELS.

1. (p. 328.) $65 \times 20 \times 10 = 13000; 13000 \div 95 = 136\frac{1}{8}\text{ tons, }$ Ans.
2. $70 \times 24 \times 12 = 20160; 20160 \div 95 = 212\frac{4}{19}\text{ tons, }$ Ans.
3. $\frac{2}{3} \text{ of } 30 = 18; 70 - 18 = 52; 52 \times 30 \times 9 = 14040; 14040 \div 95 = 147\frac{1}{8}\text{ tons, }$ Ans.
4. $\frac{2}{3} \text{ of } 22 = 13.2; 75 - 13.2 = 61.8; 61.8 \times 22 \times 12 = 16315.2; 16315.2 \div 95 = 171\frac{4}{17}\frac{1}{5}\text{ tons, }$ Ans.
5. $\frac{2}{3} \text{ of } 35 = 21; 98 - 21 = 77; 77 \times 35 \times 17\frac{1}{2} = 47162.5; 47162.5 \div 95 = 496\frac{17}{47}\text{ tons, }$ Ans.
6. $\frac{2}{3} \text{ of } 40 = 24; 180 - 24 = 156; 156 \times 40 \times 20 = 124800; 124800 \div 95 = 1313\frac{1}{8}\text{ tons, }$ Ans.

7. $\frac{3}{8}$ of 21 = 12.6 ; $78 - 12.6 = 65.4$; $65.4 \times 21 \times 9 = 12360.6$; $12360.6 + 95 = 130\frac{5}{15}$ tons, Ans.
 8. $\frac{3}{8}$ of 30 = 18 ; $159 - 18 = 141$; $141 \times 30 \times 15 = 63450$; $63450 + 95 = 667\frac{1}{15}$ tons, Ans.
 9. $\frac{3}{8}$ of 80 = 48 ; $479 - 48 = 431$; $431 \times 80 \times 48 = 1655040$; $1655040 + 95 = 17421\frac{9}{15}$ tons, Ans.
 10. $\frac{3}{8}$ of 35 = 21 ; $200 - 21 = 179$; $179 \times 35 = 6265$; $6265 \times 17\frac{1}{2} = 109687.5$; $109687.5 + 95 = 1154\frac{3}{5}$ tons, Ans.
 11. $\frac{3}{8}$ of 40 = 24 ; $280 - 24 = 256$; $256 \times 40 \times 20 = 204800$; $204800 + 95 = 2155\frac{1}{8}$ tons, Ans.
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SECTION LXXVIII.

MENSURATION OF LUMBER.

1. (p. 330.) $24 \times 8 = 192$; $192 + 12 = 16$ feet, Ans.
 2. $30 \times 16 = 480$; $480 + 12 = 40$ feet, Ans.
 3. $3 \times 5 \times 15 \times 3 = 675$; $675 + 12 = 56\frac{1}{4}$ feet, Ans.
 4. $2 \times 6 \times 10 \times 20 = 2400$; $2400 + 12 = 200$ feet, Ans.
 5. $40 + 4 = 10$; $10 \times 10 = 100$; $100 \times 30 = 3000$; $3000 + 144 = 20\frac{5}{6}$ feet, Ans.
 6. $56 + 4 = 14$; $14 \times 14 = 196$; $196 \times 50 = 9800$; $9800 + 144 = 68\frac{1}{15}$ feet, Ans.
 7. $120 + 4 = 30$; $30 \times 30 = 900$; $900 \times 90 = 81000$; $81000 + 144 = 562\frac{1}{4}$ feet, Ans.
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SECTION LXXIX.

PHILOSOPHICAL PROBLEMS.

2. (p. 331.) $1 \times 1 : \frac{1}{4} \times \frac{1}{4} :: 39.2 : 2\frac{9}{20}$ in. Ans.
3. $1 \times 1 : 60 \times 60 :: 39.2 : 141120$ in. ; $141120 + 12 = 11760$; $11760 + 3 = 3920$ yd. Ans.

4. $39.2 : 100 \times 12 :: 1 \times 1 : 30.6122 ; \sqrt{30.6122} = 5.53$
seconds, Ans.
5. $2000 + 4000 = 6000 ; 6000^3 : 4000^3 :: 900\text{lb.} : 400\text{lb.}$
Ans.
6. $20000 + 4000 = 24000 ; 24000^3 : 4000^3 :: 144\text{lb.} : 4\text{lb.}$
Ans.
7. $1 : 2 :: 4000^3 : 32000000 ; \sqrt{32000000} = 5656.85 ;$
 $5656.85 - 4000 = 1656.85$ miles, Ans.
8. $4000^3 : 240000^3 :: 150\text{lb.} : 540000\text{lb.}$ Ans.
9. $400 : 900 :: 4000^3 : 36000000 ; \sqrt{36000000} = 6000 ;$
 $6000 - 4000 = 2000$ miles, Ans.
10. $2180^3 = 10360232000 ; 10360232000 \times 494 = 51179-54608000$ = cube of the moon's diameter multiplied by its density ; $7964^3 = 505119057344 ; 505119057344 \times 400 = 202047622937600$ = cube of the earth's diameter multiplied by its density. $5117954608000 : 202047622937600 :: 6 : 236.8+$ feet, Ans.
11. $2654 \times 400 = 1061600 = \frac{2}{3}$ of the earth's semidiameter multiplied by its density ; $294415 \times 100 = 29441500 = \frac{2}{3}$ of the sun's semidiameter multiplied by its density ; $26347 \times 67 = 1765249 = \frac{2}{3}$ of Saturn's diameter multiplied by his density ; $29723 \times 94.5 = 28088235 = \frac{2}{3}$ of Jupiter's diameter multiplied by his density ; $726 \times 494 = 358644 = \frac{2}{3}$ moon's diameter multiplied by its density.
 $1061600 : 29441500 :: 170\text{lb.} : 4714.6+$ lb. = the man's weight at the sun ;
 $1061600 : 1765249 :: 170\text{lb.} : 282.6+$ lb. = the man's weight at Saturn ;
 $1061600 : 28088235 :: 170\text{lb.} : 449.7+$ lb. = the man's weight at Jupiter ;
 $1061600 : 358644 :: 170\text{lb.} : 57.4+$ lb. = the man's weight at the moon ; } Ans.
13. $1^{\circ} : 60^{\circ} = 3600 :: 16\text{ft.} : 10\text{m.} 1600\text{yd.}$ Ans.
14. $1^{\circ} : 3600^2 = 12960000 :: 16\text{ft.} : 39272\text{m.} 1280\text{yd.}$ Ans.

15. $24 \times 60 \times 60 \times 9 = 777600$ = seconds in 9 days ; $1^2 :$
 $777600^2 = 604661760000 :: 16\text{ft.} : 9674588160000\text{ft.} ;$
 $9674588160000 \div 3 = 3224862720000\text{yd.} ; 3224862-$
 $720000 \div 1760 = 1832308363\text{m.} 1120\text{yd. Ans.}$
16. $660 \div 8 = 82\frac{1}{2} ; 82\frac{1}{2} \times 82\frac{1}{2} = 6806\frac{1}{4}\text{ft. Ans.}$
17. $1000 \div 8 = 125 ; 125 \times 125 = 15625\text{ft.} ; 15625 \div 5280$
 $= 2\text{mt.} 5065\text{ft. Ans.}$
18. $200 \div 8 = 25 ; 25 \div 4 = 6\frac{1}{4}\text{sec. Ans.}$
19. $320 \div 8 = 40 ; 40 + 4 = 10\text{sec. Ans.}$
20. $\sqrt{40000} = 200 ; 200 \div 4 = 50\text{sec. Ans.}$
21. $\sqrt{400} = 20 ; 20 \div 4 = 5\text{sec. Ans.}$
23. $220 \times 64 = 16080 ; \sqrt{16080} = 118.659+ ; 118.659$
 $\times 2240 \times 4 = 1,063,184.6+ \text{lbs. Ans.}$

SECTION LXXX.

MECHANICAL POWERS.

1. (p. 336.) 1ft. : 9ft. :: 170lb. : 1530lb. Ans.
2. 9ft. : 1ft. :: 1530lb. : 170lb. Ans.
3. 170lb. : 1530lb. :: 1ft. : 9ft. Ans.
4. 1530lb. : 170lb. :: 9ft. : 1ft. Ans.
5. $4,000,000,000,000,000,000,000,000 \times 100 = 400,000,000,000,$
 $000,000,000,000 ; 200\text{lb.} : 400,000,000,000,000,000,$
 $000,000\text{lb.} :: 6000 \text{ miles} : 12,000,000,000,000,000,$
 $000,000,000 \text{ miles, Ans.}$
6. $6000\text{m.} : 12,000,000,000,000,000,000,000\text{m.} :: 1\text{in.} :$
 $2,000,000,000,000,000,000\text{in.} ; 2,000,000,000,000,$
 $000,000,000 \div 12 = 166,666,666,666,666,666\frac{2}{3}\text{ft.} ;$
 $100\text{ft.} : 166,666,666,666,666,666\frac{2}{3}\text{ft.} :: 1\text{sec.} :$
 $1,666,666,666,666,666,666\frac{2}{3}\text{sec.} ; 1,666,666,666,666,$
 $666,666 \div 60 = 27,777,777,777,777,777,777\text{m.} 46\frac{2}{3}\text{sec.} ;$
 $27,777,777,777,777,777 \div 60 = 462,962,962,962,962\text{h.}$
 $57\text{m.} ; 462,962,962,962,962 \div 8766 = 52,813,479,690\text{y.}$
 $17\text{d.} 14\text{h.} 57\text{m.} 46\frac{2}{3}\text{sec. Ans.}$

7. 4ft. = 48in. : 6in. :: 960lb. : 120lb. Ans.
8. 6in. : 48in. :: 120lb. : 960lb. Ans.
9. 120lb. : 960lb. :: 6in. : 48in. = 4ft. Ans.
10. 960lb. : 120lb. :: 48in. : 6in. Ans.
11. $400\text{lb.} \div 2 = 200\text{lb.}$ Ans.
12. $2 \times 3 \times 10 = 60\text{lb.}$ Ans.
13. $2 \times 2 \times 144 = 576\text{lb.}$ Ans.
14. 6in. : 60in. :: 1 : 10; $144\text{lb.} \times 2 \times 2 \times 10 = 5760\text{lb.}$ Ans.
15. $1000\text{lb.} \times 10 = 10,000;$ $10,000 \div 50 = 200\text{lb.}$ Ans.
16. $1728\text{lb.} \times 5 = 8640;$ $8640 \div 600 = 14\frac{2}{5}\text{lb.}$ Ans.
17. $20000\text{lb.} \times 50\text{ft.} = 1000000;$ $1000000 \div 5280 = 189\frac{1}{3}\text{lb.}$ Ans.
18. $30 \times 2000 = 60000;$ $60000 \div 300 = 200\text{lb.}$ Ans.
19. $5000 \times 100 = 500000;$ $500000 \div 1000 = 500\text{lb.}$ Ans.
20. $7000 \times 30 = 210000;$ $210000 \div 300 = 700\text{lb.}$ Ans.
21. $1 : 3.141592\text{in.} \times 10 \times 2 \times 12 :: 100\text{lb.} : 75398.208+\text{lb.}$
Ans.
22. $3.141592 \times 2 \times 100 : \frac{1}{2}\text{in.} :: 100000\text{lb.} : 79.5774+\text{lb.}$
Ans.
23. $\frac{1}{2}\text{in.} : 3.141592\text{in.} \times 200 :: 79.5774+\text{lb.} : 100,000\text{lb.}$ Ans.
24. $100,000\text{lb.} : 79.5774+\text{lb.} :: 3.141592\text{in.} \times 2 \times 100 : \frac{1}{2}\text{in.}$ Ans.
25. $79.5774+\text{lb.} : 100.000 :: \frac{1}{2}\text{in.} : 628.3184+\text{in.};$ $628.3184 \div 3.141592 = 200\text{in.};$ $200 \div 2 = 100\text{in.}$ Ans.
26. $2 \div 2 = 1\text{in.} : 20\text{in.} :: 100\text{lb.} : 2000\text{lb.}$ Ans.
27. $.75 : 3.141592 \times 16 \times 2 \times 12 :: 200\text{lb.} : 3216990.208\text{lb.};$
 $1.5 \div 2 = .75\text{in.} : 12\text{in.} :: 3216990.208\text{lb.} : 51471.843+\text{lb.}$ Ans.

SECTION LXXXI.

SPECIFIC GRAVITY.

1. (p. 341.) $10\text{lb.} - 6\frac{1}{2}\text{lb.} = 3\frac{1}{2}\text{lb.}$; $3\frac{1}{2}\text{lb.} : 10\text{lb.} :: 1000\text{oz.} :$
 $2608.6 + \text{oz.}$ Ans.
 2. $18\text{lb.} - 16\text{lb.} = 2\text{lb.}$; $15\text{lb.} + 18\text{lb.} = 33\text{lb.}$; $33\text{lb.} - 6\text{lb.} = 27\text{lb.}$; $27\text{lb.} - 2\text{lb.} = 25\text{lb.}$; $25\text{lb.} : 15\text{lb.} :: 1000\text{oz.} :$
 600oz. Ans.
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SECTION LXXXII.

STRENGTH OF MATERIALS.

1. (p. 343.) 200 pounds.
2. 4000 pounds.
3. 4in. : 3in. :: 2000lb. : 1500lb. Ans.
4. $3^2\text{in.} : 6^2\text{in.} :: 1000\text{lb.} : 4000\text{lb.}$ Ans.
5. $2 \times 4^2 : 4 \times 6^2 :: 1000\text{lb.} : 4500\text{lb.}$ Ans.
6. $\frac{2 \times 3^2}{2} : \frac{3 \times 6^2}{4} :: 4000\text{lb.} : 12000\text{lb.}$ Ans.
7. $\frac{4 \times 6^2}{10} : \frac{8 \times 10^2}{20} :: 4 \text{ tons} : 11\frac{1}{2} \text{ tons,}$ Ans.
8. $\frac{6^3}{8} : \frac{10^3}{10} :: 2000\text{lb.} : 7407\frac{1}{4}\text{lb.}$ Ans.
9. $1200\text{lb.} : 2000\text{lb.} :: \frac{5^3}{15} \text{ft.} : 36\frac{1}{2}\frac{2}{3}\text{ft.}$ Ans.
10. $3000\text{lb.} : 2000\text{lb.} :: \frac{7^2}{8} : 26\frac{1}{2}$; $26\frac{1}{2} \times 6 = 169$; $\sqrt{169} = 5.5 + \text{in.}$ Ans.
11. 10 tons : 30 tons :: $\frac{2 \times 3^2}{10} : \frac{14}{10}$; $\frac{14}{10} \times \frac{1^2}{3} = \frac{64}{30} = 21.6$; $\sqrt{21.6} = 4.64 + \text{in.}$ Ans.
12. $24 \div 2 = 12$; $24 - 4 = 20$; $12^2 : 20 \times 4 :: 1000\text{lb.} :$
 $555\frac{1}{2}\text{lb.}; 555\frac{1}{2}\text{lb.} : 1000\text{lb.} :: 1000\text{lb.} : 1800\text{lb.}$ Ans.
13. $\frac{6^3}{10} : \frac{10^3}{12} :: 2000\text{lb.} : 77220 + \text{lb.}$; $12 \div 2 = 6$; $6 - 2 = 4$; $6 + 2 = 8$; $4 \times 8 : 6^2 :: 77220\text{lb.} : 86872\frac{1}{2}\text{lb.}$ Ans.

SECTION LXXXIII.

ASTRONOMICAL PROBLEMS.

3. (p. 345.) $1841 \div 4 = 460$; $1841 + 460 = 2301$; $2301 \div 7 = 328$, and 5 remainder; $8 - 5 = 3 = C$, Ans.
 4. $1899 \div 4 = 474$; $1899 + 474 = 2373$; $2373 \div 7 = 339$, and 0 remainder; therefore A, Ans.
 5. $1896 \div 4 = 474$; $1896 + 474 = 2370$; $2370 \div 7 = 338$, and 4 remainder; $8 - 4 = 4 = D$ and E, Ans.
 6. $1786 \div 4 = 446$; $1786 + 446 = 2232$; $2232 \div 7 = 318$, and 6 remainder; $7 - 6 = 1 = A$, Ans.
 7. $1837 \div 4 = 459$; $1837 + 459 = 2296$; $2296 \div 7 = 328$, remainder 0; therefore A, Ans.

OPERATION.

$$\begin{array}{r} 4) 1849 \\ \underline{462} \\ 7) 2311 \\ \underline{330} - 1 \\ 8 - 1 = 7 \end{array}$$

10.

As 7 remains, the dominical letter will be G; therefore January will begin on Monday, and the 7th day will be the Sabbath. The 7th of December will, therefore, by the rule, be on Friday, and the 8th will be Saturday, Ans.

OPERATION.

$$\begin{array}{r} 4) 1857 \\ \underline{464} \\ 7) 2321 \\ \underline{331} - 4 \\ 8 - 4 = 4 \end{array}$$

11.

As 4 remains, the dominical letter will be D, and January will begin on Thursday; therefore the 4th day will be the Sabbath, and the 4th of July will be Saturday, Ans.

OPERATION.

$$\begin{array}{r} 4) 1890 \\ \underline{472} \\ 7) 2362 \\ \underline{337} - 3 \\ 8 - 3 = 5 \end{array}$$

12.

As 5 remains, the dominical letter will be E, and January will begin on Wednesday; therefore the Sabbath will be on the 5th, and the 5th of March will be on Wednesday, and the first day will be Saturday, Ans.

OPERATION.

$$\begin{array}{r} 4) 1776 \\ \underline{444} \\ 72220 \\ \underline{317} - 1 \\ 7 - 1 = 6 \end{array}$$

OPERATION.

$$\begin{array}{r} 4) 1874 \\ \underline{468} \\ 72342 \\ \underline{334} - 4 \\ 8 - 4 = 4 \end{array}$$

13.

As 6 remains, the dominical letters will be F and G; but F will be the dominical letter for July, and the 6th of July will be on Saturday, and the 4th will be on Thursday, Ans.

14.

As 4 remains, the dominical letter will be D; therefore January will begin on Thursday, and the 4th day will be the Sabbath, and the 4th of December will be Friday, and the 8th will be Tuesday, Ans.

SECTION LXXXIV.

MISCELLANEOUS QUESTIONS.

1. (p. 347.) $6\frac{3}{4} \div 7\frac{1}{2} = \frac{50}{57}$ Ans.
2. $4\frac{1}{2} \times 2 = 9$; $\sqrt{9} = 3$ Ans.
3. $11\frac{3}{4} \times 5 = 57\frac{1}{4}$ Ans.
4. $9\frac{9}{16} \div 7\frac{1}{2} = 1\frac{11}{17}$ Ans.
5. $\frac{7}{19\frac{3}{4}} = \frac{8}{8} = \frac{1}{1}$ Ans.
6. $\frac{4}{5}$ of a ton = 11cwt. 1qr. 20lb.; $\frac{9}{10}$ of a cwt. = 3qr. $16\frac{1}{2}$ lb.; 11cwt. 1qr. 20lb. + 3qr. $16\frac{1}{2}$ lb. = 12cwt. 1qr. $8\frac{1}{2}$ lb. Ans.

$$7. 360^\circ : 1^\circ :: 23h. 56' 3'' : 3' 59'' 20+'' \text{ Ans.}$$

$$\begin{aligned} 8. \frac{\frac{2}{3}}{\frac{1}{4}} &= \frac{3}{4} \times \frac{8}{7} = \frac{6}{7}; 9\frac{1}{8} &= 9 + \frac{1}{8}; \frac{1}{8} = \frac{1}{2} \times \frac{1}{4} = \frac{6}{35}; 9\frac{6}{35} \\ &= \frac{821}{35}; \frac{821}{35} \times \frac{6}{7} = \frac{4926}{245}; \frac{7}{1} &= \frac{7}{1} \times \frac{1}{4} = \frac{7}{4}; 8\frac{3}{4} = \frac{35}{4}; \end{aligned}$$

$$\frac{4}{5} \times \frac{35}{8} \times \frac{7}{4} = \frac{245}{16} ; \frac{1926}{245} \times \frac{245}{8} = \frac{1926}{8} = \frac{240\frac{1}{4}}{1} [Ans.]$$

1

$$9. 12\frac{5}{7} = 12 + \frac{5}{7}; \frac{5}{7} = \frac{5}{7} \times \frac{1}{1} = \frac{5}{7}; 12\frac{5}{7} = 12\frac{1}{8};$$

$$\frac{\frac{5}{7}}{10} = \frac{1}{7} \times \frac{10}{9} = \frac{10}{63} = \frac{1}{6}; \frac{1013}{84} \times \frac{4}{9} = \frac{1013}{189} = \frac{1013}{189} \times \frac{18}{18}$$

$$= \frac{1013}{189}; \frac{\frac{3}{8}}{\frac{1}{12}} = \frac{3}{8} \times \frac{12}{11} = \frac{9}{22}; 7\frac{1}{6} = \frac{43}{6}; \frac{9}{22} \times \frac{36}{5} =$$

$$\frac{21}{2} = \frac{18}{11}$$

$$\frac{162}{552}; \frac{1013}{189} \times \frac{55}{552} = \frac{5571500}{106518} = 181\frac{14821}{106518} \text{ Ans.}$$

$$10. \frac{2}{3} \times \frac{5}{6} = \frac{10}{18}; \frac{1}{3} - \frac{10}{18} = \frac{1}{18} \text{ Ans.}$$

11. As there is a son and a daughter, the son will have $\frac{2}{3}$ of the estate, the wife $\frac{1}{3}$, and the daughter $\frac{1}{12}$. If there had been only a daughter, her share would have been $\frac{1}{3}$; consequently she loses $\frac{1}{3} - \frac{1}{3} = \frac{1}{21}$. Hence

$$\frac{1}{21} : \frac{1}{12} :: \$2400 : \$2100 \text{ Ans.}$$

$$12. \frac{1}{3} \times \frac{5}{6} = \frac{5}{18} = 5\text{h. } 32\text{m. } 18\frac{2}{3}\text{sec. Ans.}$$

Note. — We use the fraction $\frac{13}{13}$, because the minute-hand passes the hour-hand twelve times in thirteen hours.

$$13. \frac{1}{3} + \frac{1}{4} = \frac{7}{12}; \frac{1}{3} = \frac{4}{12}; \frac{1}{4} = \frac{3}{12};$$

$$\frac{7}{12} : \frac{4}{12} :: \$100,000 : \$57,142 \frac{2}{7} \text{ A's part, } \left. \right\} \text{ Ans.}$$

$$\frac{7}{12} : \frac{3}{12} :: \$100,000 : \$42,857 \frac{1}{7} \text{ B's part, } \left. \right\} \text{ Ans.}$$

14. If the first man's share be subtracted from the whole, there will remain $\frac{13}{13} - \frac{7}{13} = \frac{6}{13}$; and $\frac{6}{13}$ of $\frac{1}{12} = \frac{1}{24}$ = the second son's share. And $\frac{7}{13} - \frac{1}{24} = \frac{14}{24} =$ difference of their legacies. $\frac{1}{12} = \frac{2}{24}; \frac{1}{24} + \frac{1}{24} = \frac{2}{24} = \frac{1}{12}$ = legacy of both sons. Hence $\frac{1}{24} - \frac{1}{12} = \frac{1}{24}$ = wife's legacy. Therefore

$$\frac{1}{24} : \frac{1}{12} :: 257\text{£. } 3\text{s. } 4\text{d.} : 635\text{£. } 0\text{s. } 10\frac{1}{2}\text{d. Ans.}$$

15. $63 \times 12 \times 12 \times 1000 \times 3 = 27216000$; $27216000 + 16 = 1701000$ lb.; $1701000 + 2240 = 759\frac{3}{4}$ tons, Ans.

16. 4ft. = 48in.; 6in. \times 2 = 12in.; $48 - 12 = 36$ in.; $36 + 2 = 18$ in.; $18 + 12 = 30$ in.; 48in. : 30in. :: 200lb. : 175lb. Ans. $48 - 30 = 18$ in.; 48in. : 18in. :: 200lb. : 75lb. Ans.

17. 25ft. 4in. = 304in.; 4ft. 5in. = 53in.; 3ft. 5in. = 41in., $53 \times 41 = 2173$; $53 - 41 = 12$ in.; $12 \times 12 = 144$; $144 + 3 = 48$; $2173 + 48 = 2221$; $2221 \times .785398 = 1744.368958$; $1744.368958 \times 304 \times 304 \times 8 = 4242305.305856$; $4242305.305856 \div 1728 = 2455.037792$ = cubic feet in the pillars. $2455.037792 \times 3000 = 7365113.376$ = weight in ounces; $7365113.376 \div 16 = 460319.586$ lbs.; $460319.586 \div 2240 = 205.49981$ tons, Ans.

18. If $\frac{3}{4}$ of a certain sum be taken, and \$410 be left, it is evident that \$410 is $\frac{1}{4}$ of that sum, which is $\frac{410 \times 7 + 4}{4} = \$717\frac{1}{2}$. Now, if \$717 $\frac{1}{2}$ remain of a certain quantity after $\frac{1}{4}$ be subtracted, it is certain that the number from which it is taken is $\frac{4}{3}$ of \$717 $\frac{1}{2}$ = \$956.66 $\frac{2}{3}$ Ans.

19. $20 \times 19 \times 18 \times 17 \times 16 \times 15 \times 14 \times 13 \times 12 \times 11 = 670442572800$; $1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 \times 9 \times 10 = 3628800$; $670442572800 \div 3628800 = \1847.56 Ans.

20. $\frac{1}{4} : \$15.60 :: \$100 : \$6240$ = sum remitted; $\$96 : \$100 :: \$6240 : \6500 = value of goods sold; $\$6500 - \$6240 = \$260$ = commission, Ans.

21. $\$107.50 : \$100 :: \$9675 : \9000 ; $\frac{9}{10} \times \$9000 = 2025$ £. sterling = the bill; $\$100 - \$0.25 = \$99.75$; $\$100 : \$99.75 :: \$9675 : \$9650.81\frac{1}{4}$; $\$102 : \$100 :: \$9650.81\frac{1}{4} : \$9461.58\frac{3}{4}$ for investment, Ans.

22. $15 \times 30 = 450$; $15 \times 15 = 225$; $225 + 3 = 75$, $450 + 75 = 525$; $525 \times 220 = 115500$ = contents of the whole monument, and from this we deduct the contents of the cylinder. $15 \times 11 = 165$; $4 \times 4 = 16$; $16 \div 3 = 5\frac{1}{3}$; $165 + 5\frac{1}{3} = 170\frac{1}{3}$; $170\frac{1}{3} \times .785398 = 133.779459\frac{1}{3}$; $133.779459\frac{1}{3} \times 220 = 29431.481953\frac{1}{3}$ = contents of the cylinder; 115500

— 29431.481953 $\frac{1}{2}$ = 86068.51894 + cubic feet of the monument, Ans.

23. $\frac{1}{2} \times 1 + \frac{1}{2} \times \frac{1}{2} + \frac{1}{2} \times \frac{1}{3} = \frac{11}{8}$ A's product;

$\frac{1}{2} \times \frac{1}{2} + \frac{1}{2} \times \frac{1}{3} = \frac{5}{8}$ M's product;

$\frac{1}{2} \times \frac{1}{3} = \frac{1}{6}$ P's product;

$\frac{27}{8}$ sum of the products.

$\frac{11}{8} : \$300 :: \frac{5}{8} : \$183.33\frac{1}{2}$ = A pays,

$\frac{11}{8} : \$300 :: \frac{1}{6} : \$83.33\frac{1}{2}$ = M pays, } Ans.

$\frac{11}{8} : \$300 :: \frac{1}{6} : \$33.33\frac{1}{2}$ = P pays,

24. A $20 \times \$132 = \2640

B $25 \times \$120 = \3000

$85 \times \$6 = \510

C $\underline{40 \times \$100 = \$4000}$

$\underline{85} \quad \underline{\$9640}$

$\$9640 : \$510 :: \$2640 : \$139\frac{1}{2}$ A receives,

$\$9640 : \$510 :: \$3000 : \$158\frac{1}{2}$ B receives, } Ans.

$\$9640 : \$510 :: \$4000 : \$211\frac{1}{2}$ C receives,

25. $\$100 \times \$5.00 = \$500$ given for the flour;

$\$500 \times \$0.20 = \$100$ gained on the flour;

$\underline{\$600}$

$\$100 \times \$0.03,0\frac{1}{2} = \$3.05$ bank interest of $\$100$ for 6

months; $\$100 - \$3.05 = \$96.95$

$\$100 : \$96.95 :: \$600 : \$618\frac{1}{2}$; $\$618\frac{1}{2} \div 100 = \$6.18\frac{1}{2}$ Ans.

26. $5\frac{1}{4} \times 1\frac{1}{8} = \frac{31}{32}$ square yards of broadcloth; $\frac{3}{4} - \frac{1}{4} \times \frac{1}{8}$

$= \frac{3}{4} - \frac{1}{32} = \frac{11}{16}$ yd. = width of flannel after being shrunk;

$\frac{31}{32} \div \frac{11}{16} = \frac{5}{4}\frac{1}{8}$ = $12\frac{3}{8}$ yd. = length of flannel necessary

to line the broadcloth if it had not shrunk in length; 19yd. :

20yd. :: $12\frac{3}{8}$ yd. : $12\frac{3}{8}$ yd. quantity necessary to buy, Ans.

27. $40 \times 2 = 80$ ft.; $30 - 2 = 28$ ft.; $28 \times 2 = 56$ ft.;

$80 + 56 = 136$ ft.; $136 \times 20 = 2720$ cubic feet; $2720 \times$

$1728 = 4700160$ cubic inches in the walls of the building;

$8 \times 4 \times 2 = 64$ cubic inches in a brick; $4700160 \div 64 =$

73440 bricks, Ans.

28. As the roof projects 1ft. over the plate, it will be 42ft. square ; $42 \div 2 = 21$ ft. ; $21 \times 21 = 441$ ft. ; $15 \times 15 = 225$ ft. ; $\sqrt{441 + 225} = 25.8069$ + feet, being the distance from the top of the house to the plate ; $25.8069 \div 2 = 12.9034$ ft. ; $12.9034 \times 42 \times 4 = 2167.7712$ square feet in the roof; $40 + 40 = 80$ ft. ; $80 \times 2 = 160$ ft. ; $160 \times 20 = 3200$ ft. required to cover the body of the house ; $3200 + 2167.7712 = 5367.7712$ square feet of boards necessary to cover the house, Ans.

29. \$ 300 : \$ 700 :: 20 months : $46\frac{2}{3}$ months, Ans.

30. $\$ 1500 \div 150 = 10$; $10 + 2 = 12$ children. $\$ 1500 \times 2 = \$ 3000$; $\$ 3000 \div 3 = \$ 1000$; $\$ 3000 + \$ 1000 = \$ 4000$; $\$ 4000 \div 4 = \$ 1000$; $\$ 4000 + \$ 1000 = \$ 5000$; $\$ 5000 \times 2 = \$ 10,000$ Ans.

31. $7 - 5 = 2$ miles which B gains each day, and he will have to gain 80 miles before he overtakes A. 2 miles : 80 miles :: 1 day : 40 days, the time which it takes B to overtake A. And as B travels 7 miles each day, he will have to go, before he overtakes A, $40 \times 7 = 280$ miles, Ans.

32. 16lb. : 80lb. :: 24.4in. : 122 cubic inches of lead. $\frac{1}{4} \times 2 = \frac{1}{2}$ in. ; 1 in. + $\frac{1}{2}$ in. = 1.5 inches ; $1.5 \times 1.5 = 2.25$; $2.25 \times .785398 = 1.7671455$ = area of a section of the pipe. From this we subtract the area of a section of the calibre of the pipe. $1 \times .785398 = .785398$; $1.7671455 - .785398 = .9817475$; $122 \div .9817475 = 124.26 +$ inches, Ans.

33. $.785398 \times 2 \times 2 = 3.141592$; $\frac{3}{4} \times \frac{3}{4} \times .785398 = .441786$; $3.141592 - .441786 = 2.699806$; $2.699806 \times 8 = 21.598448$; $\frac{3}{4} \times 2 = \frac{6}{4} = \frac{3}{2}$; $\frac{3}{2} + \frac{3}{4} = 1.5$; $1.5 \times 1.5 = 2.25$; $.785398 \times 2.25 = 1.7671455$; $1.7671455 - .441786 = 1.3253595$; $21.598448 \div 1.3253595 = 16.29 +$ in. Ans.

34. Let \$ 100 represent the *relative* value of what D pays ; then $\$ 100 \times 1.08 = \$ 108$ will represent what C pays ; $\$ 108 \times 1.10 = \$ 118.80$, what B pays ; and $\$ 118 \times 1.08 = \$ 133.056$, what A pays. $\$ 100 + \$ 108 + \$ 118.80 + \$ 133.056 = \$ 459.856$.

$$\$459.856 : \$100 :: \$100 : \$21.741\frac{796}{941} \text{ D pays.}$$

$$\$459.856 : \$100 :: \$108 : \$23.481\frac{643}{941} \text{ C pays.}$$

$$\$459.856 : \$100 :: \$118.80 : \$25.831\frac{199}{941} \text{ B pays.}$$

$$\$459.856 : \$100 :: \$133.056 : \$28.934\frac{777}{941} \text{ A pays.}$$

$20 \times 20 \times 20 = 8000$; $\$459.856 : \$133.056 :: 8000 : 2314.742006$; $\sqrt[3]{2314.742006} = 13.22 + \text{ft.}$ which A takes.
 $\$459.856 : \$251.856 :: 8000 \text{ ft.} : 4381.47594 \text{ ft.}; \sqrt[3]{4381.47594} = 16.36 + \text{ft.}$; $16.36 - 13.22 = 3.14 + \text{ft.}$ which B takes.
 $\$459.856 : \$359.856 :: 8000 \text{ ft.} : 6260.324971 \text{ ft.}; \sqrt[3]{6260.324971} = 18.42 \text{ ft.}; 18.42 - 16.36 = 2.06 + \text{ft.}$ which C takes.
 $20 - 18.42 = 1.58 + \text{ft.}$ which remains for D.

36. $18.5 \times 18.5 \times 18.5 \times 8 = 50653$; $\sqrt[3]{50653} = 37 \text{ in. wide}; 8 \times 8 \times 8 \times 8 = 4096$; $\sqrt[3]{4096} = 16 \text{ in. deep, Ans.}$

37. As the metal is 1 in. thick, the diameter of the inner sphere is 3 in.; $5 \times 5 \times 5 \times .5236 \times \frac{1}{60} = 16.8861 \text{ lb.}$, weight of the shell, if it were solid iron; $3 \times 3 \times 3 \times .5236 \times \frac{1}{60} = 3.6473976 \text{ lb.}$, weight of the inner sphere if it were iron; $16.8861 - 3.6473976 = 13.2387 + \text{lb.}$ Ans.

38. By POSITION.—Suppose the time to be 16 minutes past 2 o'clock, the hour-hand must have passed $\frac{16}{60}$ of the distance from 2 o'clock to 3 o'clock; and if the minute-hand were in the place of the hour-hand, it would be 11m. 20sec. from 12 o'clock. And if the hour-hand were in the place of the minute-hand, the time would be 12 minutes past 3 o'clock. The difference between 12m. and 11m. 20sec. is 40sec. Let these be the first error. Again, suppose the time to be 18 minutes past 2 o'clock; the hour-hand, at that time, has passed $\frac{18}{60}$ of the distance from 2 o'clock to 3 o'clock; and if the minute-hand were in the place of the hour-hand, it would be 11m. 30sec. from 12 o'clock. And if the hour-hand were in the place of the minute-hand, the time would be 36 minutes past 3 o'clock. The difference between 36m. and 11m. 30sec. is 24m. 30sec. = 1470sec. Let these be the second error. Both errors are plus. We now proceed as in the operation: —

$$\begin{array}{r} 16 \times 40+ \\ 18 \quad 1470+ \\ \hline 40 \quad 16 \\ \hline 720 \quad 23520 \\ - \quad 720 \\ \hline \end{array}$$

$$1470 - 40 = 1430) 22800(15m. 56\frac{2}{3}\text{sec. past 2 o'clock,}$$

1430

[Ans.]

8500

7150

1350

60

$$1430) 81000(56\frac{2}{3}\text{sec.}$$

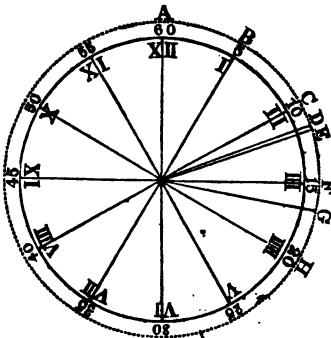
7150

9500

8580

920

By ANALYSIS.—Let the annexed diagram represent the face of a clock; A, or 60, the 12 o'clock mark; B, 5 minutes; C, 10 minutes; F, 15 minutes; H, 20 minutes, &c., round the same. Suppose, then, the two hands to be together at A, and then the minute-hand to be moved forward $\frac{24}{5}$ times round, and it will be at F, having moved 135 minutes; and the hour-hand will have moved to a point, which call D, between C and F. Suppose, then, the minute-hand to be moved still forward to the place required by the supposition, between F and H, which place call G. The hour-hand will then have moved to its place required be-



tween C and F, which place call E. Then, DE being $\frac{1}{12}$ of FG, and FG being $\frac{1}{12}$ of AE, it is evident that DE = $\frac{1}{12}$ of $\frac{1}{12}$ of AE, that is, $\frac{1}{144}$ part of AE; and AD is the other $\frac{13}{144}$ of AE; and so, while the minute-hand moves from A twice round and to G, the hour-hand moves from A to E; and while the minute-hand moves from A to E, the hour-hand moves from F to G; therefore, as $143 : 144 :: 135\text{m.} : 135\frac{13}{144}\text{m.} = 2\text{h. } 15\frac{13}{144}\text{m.}$ = the time at which the hands were in the first position, the minute-hand being $\frac{13}{144}$ of a minute beyond the 3 o'clock mark. Again, $135\frac{13}{144}\text{m.} \div 12 = 11\frac{47}{144}\text{m.}$ = the minute on the face where the hour-hand was at first. Again, $15\frac{13}{144}\text{m.} - 11\frac{47}{144}\text{m.} = 4\frac{88}{144}\text{m.} = 4\frac{11}{18}\text{m.}$ = the minutes between the two hands. Again, $60\text{m.} - 4\frac{11}{18}\text{m.} = 55\frac{5}{18}\text{m.}$ = the time between the hands changing places; and $2\text{h. } 15\frac{13}{144}\text{m.} + 55\frac{5}{18}\text{m.} = 3\text{h. } 11\frac{47}{144}\text{m.}$ = the time on the clock when the hands would have changed places; and $11\frac{47}{144}\text{m.} \div 12 = \frac{13}{144}$ of 1 minute = place of the hour-hand beyond the 3 o'clock mark at the time of changing places, Q. E. D.

39. $20 \times 20 \times 20 = 8000$ cubic inches = contents of the larger cube. $20 \times 20 = 400$; $400 \div 3 = 133.33+$; $\sqrt{133.3} = 11.5469+$; $11.5469^3+ = 1539.58+$ cubic inches = contents of the smaller cube, Ans.

40. $90 \times 40 = 3600$; $\sqrt{3600} = 60\text{lb. true weight, Ans.}$
 $90 - 60 = 30\text{lb.}; 60 - 40 = 20\text{lb.}; 30\text{lb.} : 20\text{lb.} :: 3\text{ft.} : 2\text{ft.}$; that is, the arms of the scales are to each other as 2ft. to 3ft. Ans.

41. Both wheels being of the same height, and the outer wheel making two turns, while the inner one makes only one turn, it will follow, that the outer ring will be twice the diameter of the inner ring. The distance between the rings being 5 feet, and the circumferences of circles being as their diameters, it will also follow, that the diameter of the inner ring will be 10 feet, and the diameter of the outer ring 20 feet.

And if the diameter be 20 feet, the circumference will be 62.83+ feet, Ans.

$$42. \quad 72 \times 72 \times 3.141598 = 57001\text{d.} = 237\text{£. } 10\text{s. } 1\text{d. Ans.}$$

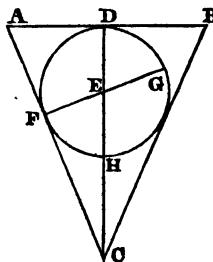
43. The annexed diagram may represent the conical glass, A B C being the cone, and F D G H a globe or sphere immersed in it. If A B be 5 inches, A D will be 2.5 inches, because A D is half of A B. A D C is a right-angled triangle; therefore the side A C may be found; thus, $\sqrt{AD^2 + DC^2} = AC$; $\sqrt{2.5^2 + 6^2} = 6.5 = AC$. Because A D E F is a regular figure, and the angles A D E and A F E being equal, each being a right angle, and the sides D E and

F E being also equal, because they are radii of the circle D F H G, the sides A D and A F are also equal. A D is 2.5 inches; A F is also 2.5 inches. If A C be 6.5 inches, and A F 2.5 inches, F C will be 4 inches; $6.5 - 2.5 = 4$ inches. Then, by similarity of triangles (see page 245), C D : D A :: C F : F E; 6in. : 2.5in. :: 4in. : 1 $\frac{1}{2}$ in. = F E. If F E be 1 $\frac{1}{2}$ in., F G will be 3 $\frac{1}{2}$ in. = 1 $\frac{1}{2}$ in., because F G is the diameter of the sphere, and F E the radius or semidiameter. By mensuration of solids (see pages 325 and 326), we find the contents of the cone and sphere in the following manner: —

$$5 \times 5 \times .785398 \times 2 = 39.2699\text{in.} = \text{contents of the cone};$$

$$\frac{10}{3} \times \frac{10}{3} \times \frac{10}{3} \times .5236 = 19.3925\text{in.} = \text{contents of the sphere};$$

19.8774in. = the cubic inches of water that will remain in the cone after the sphere is immersed. Having taken it for "granted," that cones, spheres, and all similar solid bodies are to each other as the cubes of their homologous sides, we say, As the quantity of water it requires to immerse the sphere in the *given* cone is to the cube of the diameter of the sphere, so is any other quantity of water in



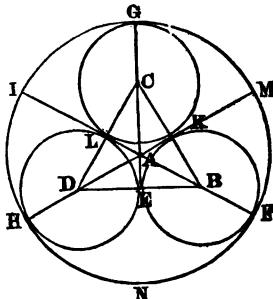
the conical glass to the cube of the diameter of a sphere that may be immersed in it. Now, the quantity of water given to immerse the *required* sphere is $\frac{1}{3}$ of the contents of the conical glass = $\frac{3.8774}{3} = 7.85398$ cubic inches. The cube of the diameter of the *given* sphere is $\frac{1}{3} \times \frac{1}{3} \times \frac{1}{3} = \frac{1}{27}$ in. Therefore

$$19.8774 \text{ in.} : \frac{1}{27} \text{ in.} :: 7.85398 \text{ in.} : 14.634114529 + \text{in.};$$

$$\sqrt[3]{14.634114529} = 2.445 + \text{in. Ans.}$$

44. Let the larger circle of the annexed figure represent the farm of the lady, and the three smaller circles the farms of her daughters. To construct this figure, make the equilateral triangle CBD , each of whose sides is 10 rods or inches. Bisect each of the sides DC , CB , BD , in the points L , E , K ; and draw the lines IF , EG , FI , at pleasure. Upon the points C , D , B , as centres, and with the distance CL as a radius, describe the circles GLK , LHE , KEF . Upon the point A , as a centre, where the lines IF and $H M$ intersect

each other, and with the radius AG , describe the circle $GICHFM$, and it will touch the peripheries of the smaller circles without cutting them. The sides of the triangle being 10, the diameter of each of the smaller circles will be 10. Because CDE is a right-angled triangle, $CE = \sqrt{CD^2 - DE^2}$; $\sqrt{10 \times 10 - 5 \times 5} = 8.660254 +$; and as CDE and ADE are similar triangles, $CE : CD :: DE : DA$; that is, $8.660254 : 10 :: 5 : 5.7735027 = AD$. If we add $HD = 5$ to DA , we have the semidiameter of the larger circle, $5.7735027 + 5 = 10.7735027$. By multiplying this last number by 2, we have the diameter of the larger circle, $10.7735027 \times 2 = 21.5470054$. As the area of a circle may be found by mul-



tipling the square of the diameter by .785398, therefore, by dividing the area by .785398, the quotient will be the square of the diameter. The area of the lady's field is 500 acres = 80000 square rods; $80000 \div .785398 = 101859.18$ square of the diameter; $\sqrt{101859.18} = 319.154006 +$ rods = diameter of the lady's farm. To find the diameter of each of the daughters' farms, we say, As the diameter of the larger circle in the diagram is to the diameter of one of the smaller circles in the diagram, so is the diameter of the lady's farm to the diameter of either of her daughters' farms. $21.5470054\text{rd.} : 10\text{rd.} :: 319.154006\text{rd.} : 148.119889 + \text{rd.}$ = diameter of the daughters' farms; and the distance of their houses from each other, $148.119889 \times 148.119889 \times .785398 = 17231.2406 +$ square rods in each of the daughters' farms; $17231.24 + \text{rd.} \div 160 = 107\text{A. } 2\text{R. } 31.24 + \text{ rods} = \text{acres, &c., in each of their farms};$ $107\text{A. } 2\text{R. } 31.24\text{rd.} \times 3 = 323\text{A. } 0\text{R. } 13.72\text{rd.}$ amount of the 3 daughters' farms; 500A. — 323A. 0R. 13.72rd. = 176A. 3R. 26.28rd. the lady retained. To find the distance of the lady's dwelling-house from those of her daughters, we subtract the semidiameter of either of the daughters' farms from that of the lady's; thus, $319.154 + \text{rd.} \div 2 = 159.577 + \text{rd.};$ $148.119 + \text{rd.} \div 2 = 74.059 + \text{rd.};$ $159.577 + \text{rd.} — 74.059 + \text{rd.} = 85.518 + \text{rd.}$ Ans.

$$45. \frac{35\frac{1}{4}}{52\frac{1}{4}} = \frac{\frac{141}{4}}{\frac{209}{4}} = \frac{246}{369} \times \frac{7}{\frac{369}{369}} = \frac{246}{369} = \frac{2}{3}; (\frac{2}{3})^3 = \frac{8}{27} \text{ Ans.}$$

$$46. \frac{782}{264\frac{1}{8}} = \frac{\frac{1122}{8}}{\frac{1323}{8}} = \frac{392}{5} \times \frac{5}{\frac{1323}{1323}} = \frac{392}{1323} = \frac{8}{27}; (\frac{8}{27})^{\frac{1}{3}} = [\frac{2}{3}] \text{ Ans.}$$

$$47. \frac{66\frac{1}{11}}{1034\frac{1}{11}} = \frac{\frac{728}{11}}{\frac{11375}{11}} = \frac{728}{11} \times \frac{11}{\frac{11375}{11375}} = \frac{728}{11375} = \frac{8}{125};$$

$$(\frac{8}{125})^{\frac{1}{3}} = \frac{2}{5}; \frac{69\frac{4}{7}}{87\frac{1}{7}} = \frac{\frac{488}{7}}{\frac{610}{7}} = \frac{488}{610} = \frac{488}{610} = \frac{4}{5}; (\frac{4}{5})^2 = \frac{16}{25}; \frac{2}{5} \times \frac{16}{25} = \frac{32}{125} \text{ Ans.}$$

$$48. \frac{14\frac{1}{3}}{21\frac{1}{3}} = \frac{\frac{130}{3}}{\frac{65}{3}} = \frac{130}{65} \times \frac{1}{\frac{65}{65}} = \frac{130}{65} = \frac{2}{1}; \frac{65\frac{1}{8}}{9\frac{1}{8}} = \frac{\frac{525}{8}}{\frac{73}{8}} = \frac{525}{73} = \frac{7}{8}$$

$$\begin{aligned} \times \frac{\frac{8}{75}}{1} &= \frac{1}{1}; \frac{2}{3} \times \frac{1}{1} = \frac{14}{3} = 4\frac{2}{3}; \frac{13\frac{1}{2}}{31\frac{1}{2}} = \frac{27}{52} = \frac{27}{2} \times \frac{2}{63} = \\ &\quad \frac{3}{7} \\ \frac{23\frac{1}{4}}{37} &= \frac{92\frac{1}{4}}{37} = \frac{92\frac{1}{4}}{4} \times \frac{1}{7} = \frac{92\frac{1}{4}}{4} ; \frac{92\frac{1}{4}}{4} \times \frac{2}{7} = \frac{27\frac{1}{4}}{14} = \\ &2\frac{7\frac{1}{4}}{14}; 4\frac{2}{3} + 2\frac{7\frac{1}{4}}{14} = 7\frac{2}{4} \text{ Ans.} \end{aligned}$$

49. \$ 648.95 + \$ 10 + \$ 20 + \$ 68.75 = \$ 747.70; \$ 3
~~\$ 747.70~~
 $\frac{+ 51 + 60}{+ 174}$; \$ 174 - \$ 174 = \$ 1.45 per day. \$ 1.45
 $\times 51 = \$ 73.95$; \$ 73.95 + \$ 20 = \$ 93.95; \$ 23.15 +
\$ 50 = \$ 73.15; \$ 93.95 - \$ 73.15 = \$ 20.80, being what
Carleton received. \$ 1.45 \times 60 = \$ 87; \$ 87 + 68.75 =
\$ 155.75; \$ 17.48 + \$ 50 = \$ 67.48; \$ 155.75 - \$ 67.48
= \$ 88.27, being what Jones received. \$ 20.80 + \$ 88.27
= \$ 109.07; \$ 400 - \$ 109.07 = \$ 290.93; \$ 17.48 +
\$ 23.15 = \$ 40.63; \$ 290.93 - \$ 40.63 = \$ 250.30, being
what Smith received, Ans.

50. 90s. = 1080d.; 3s. 9d. = 45d. As A would reap
the field in 9 days, he would in 5 days reap $\frac{5}{9}$ of the field;
therefore, $1 - \frac{5}{9} = \frac{4}{9}$ = the part of the field which B and C
reap; $\frac{18\frac{1}{2}}{18\frac{1}{2}} = \frac{2\frac{1}{2}}{2\frac{1}{2}}$; $\frac{4}{9} \div \frac{2\frac{1}{2}}{2\frac{1}{2}} = \frac{8\frac{4}{1}}{8\frac{1}{1}}$; $\frac{8\frac{4}{1}}{8\frac{1}{1}} - \frac{4\frac{1}{1}}{4\frac{1}{1}} = \frac{7\frac{3}{1}}{7\frac{1}{1}}$;
 $\sqrt{81} = 9$; $783 \div 9 = 87$; $87 \div 2 = 43.5$; $(43.5)^2 = 1892.25$;
 $1892.25 - 1080 = 812.25$; $\sqrt{812.25} = 28.5$; $43.5 - 28.5$
= 15 days = the time in which B would reap the field. We
therefore perceive that A would do $\frac{5}{9}$ of the work, and B $\frac{4}{9}$ of it, in 5 days;
 $\frac{5}{9} + \frac{4}{9} = \frac{9}{9} = 1$ of the work would be performed by A and B in 5 days. Therefore, $1 - \frac{9}{9} = \frac{0}{9}$ would
be performed by C in 2 days, or $\frac{1}{4}$ in 1 day. And if $\frac{1}{4}$ be
performed in 1 day, it is evident that it would require 18
days for C to perform the whole labor, Ans.

OPERATION BY ALGEBRA.

45. 10s. = 1080d.; 3s. 9d. = 45d. Let x = the time in
which B can do the work. Then $9 : x :: 45 : 4\frac{1}{2}$ = the sum
which C must receive from A in part payment for his labor.

Then $45 + \frac{4}{9}x$ = the money received by C for his 2 days labor. Now it is evident that the sum received by C must bear the same proportion to the sum received for the whole work, as the part of the work which he performs bears to the whole work.

Hence $\frac{45 + \frac{4}{9}x}{1080} = \frac{x+9}{216}$ denote the part of the work performed by C. Therefore $\frac{x+9}{216}$ work : 1 work :: 2 days : $\frac{2}{216}$ = $\frac{432}{x+9}$ = the time in which C would do the whole work. Now, since from the question and the operation we see that A performs $\frac{5}{9}$ of the work, B $\frac{x}{9}$ of it, and C $\frac{x+9}{216}$ of it, it is evident that $\frac{5}{9} + \frac{x}{9} + \frac{x+9}{216} = 1$ work. Or, $\frac{5}{9} + \frac{x+9}{216} = 1 - \frac{x}{9} = \frac{5}{9}$, which, being reduced and transposed, gives $x = 15$ days = the time in which B would reap the field. $\frac{432}{x+9} = \frac{432}{24} = 18$ days = the time in which C would reap the field, Ans.

51. $\$ 0.62\frac{1}{2} \times 100 = \$ 62.50$; $\$ 1.00 \times 135\frac{1}{2} = \$ 135.50$;
 $\$ 62.50 + \$ 135.50 = \$ 198$; $\$ 630 - \$ 198 = \$ 432$; $120 + 96 = 216$; $216 : 120 :: \$ 432 : \$ 240$; $\$ 240 + \$ 62.50 = \$ 302.50 - \$ 210 = \$ 92.50$, due to Jenkins. $\$ 432 - \$ 240 = \$ 192$; $\$ 192 + \$ 135.50 = \$ 327.50$; $\$ 327.50 - \$ 210 = \$ 117.50$, due to Betton, Ans.

52. $4 - \frac{1}{2} = 3\frac{1}{2}$; $4 : 3\frac{1}{2} :: 40 : 1\frac{1}{4}$; $1\frac{1}{4}$ yd. = 24na.; $24 - 1\frac{1}{2} = 22\frac{1}{2}$ na.; 24 na. : $22\frac{1}{2}$ na. :: $2\frac{1}{4}$ yd. : $2\frac{7}{8}$ yd. = $1\frac{15}{16}$ yd.; $1\frac{1}{4} \times 1\frac{3}{4} = 2\frac{9}{16}$ yd. = $81\frac{9}{16}$ yd.; 5qr. = $1\frac{1}{4}$ yd.; $20 - 1\frac{1}{4} = 18\frac{3}{4}$ yd.; $\frac{18\frac{3}{4}}{20} = \frac{15}{16}$; 5qr. = 20na.; $20 - \frac{1}{2} = 19\frac{1}{2}$; $19\frac{1}{2} \times \frac{15}{16} = 18\frac{9}{32}$ na.; $81\frac{9}{16}$ yd. = $1307\frac{1}{16}$ na.; $1307\frac{1}{16} \div 18\frac{9}{32} = 71\frac{7}{32}$ yd. Ans.

53. $i = \frac{1}{2}; (\frac{1}{2})^2 = \frac{1}{4} = .012345679$, Ans.

54. $\frac{6^3}{10} : \frac{10^3}{20} :: 1000\text{lb.} : 2314.81 + \text{lb.}; 20 \div 2 = 10; 10 - 4 = 6; 10 + 4 = 14; 14 \times 6 = 84; 10^2 = 100; 84 : 100 :: 2314.81 + \text{lb.} 2755.72\text{lb.}$ Ans.

$$\begin{aligned}
 & 55. \quad 1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 \times 9 \times 10 \times 11 \\
 & \times 12 \times 13 \times 14 \times 15 \times 16 \times 17 \times 18 \times 19 \times 20 \times 21 \\
 & \times 22 \times 23 \times 24 \times 25 \times 26 \times 27 \times 28 \times 29 \times 30 \times 31 \\
 & \times 32 \times 33 \times 34 \times 35 \times 36 \times 37 \times 38 \times 39 \times 40 \times 41 \\
 & \times 42 \times 43 \times 44 \times 45 \times 46 \times 47 \times 48 \times 49 \times 50 \times 51 \\
 & \times 52 \times 53 \times 54 \times 55 \times 56 \times 57 \times 58 \times 59 \times 60 \times 61 \\
 & \times 62 \times 63 \times 64 \times 65 \times 66 \times 67 \times 68 \times 69 \times 70 \times 71 \\
 & \times 72 = 612344583768860868615240703852746727407780 \\
 & 9178469732898382301496397838498722168927420416000 \\
 & 0000000000000 Ans.
 \end{aligned}$$

The following is the operation of examples 44 and 45, Square Root, page 248, of the last edition of the National Arithmetic.

$$\begin{aligned}
 & 44. \quad 49\frac{5}{8} = 49.625; \quad 49.625 \times 144 = 7146; \quad 7146 \times 1\frac{1}{2} = \\
 & 10719; \quad 3 \times 3 \times 3 = 27; \quad 10719 - 27 = 10692; \quad 3 \times 3 = \\
 & 9; \quad 10692 \div 9 = 1188; \quad 9 \div 4 = 2.25; \quad 1188 + 2.25 = \\
 & 1190.25; \quad \sqrt{1190.25} = 34.5; \quad 3 \div 2 = 1.5; \quad 34.5 + 1.5 = \\
 & 36 \text{ inches, Ans.}
 \end{aligned}$$

$$\begin{aligned}
 & 45. \quad 22\frac{7}{8} \times 144 \times 2\frac{1}{2} = 8105 \text{ cubic inches in the plank;} \\
 & 5 = \text{twice the thickness of the plank;} \quad 5 \times 5 \times 5 = 125; \\
 & 8105 - 125 = 7980; \quad 7980 \div 70 = 114; \quad \frac{3}{8} \times \frac{3}{8} = \frac{12}{64}; \\
 & 114 + \frac{12}{64} = \frac{90621}{64}; \quad \sqrt{\frac{90621}{64}} = \frac{301}{8}; \quad \frac{301}{8} + \frac{3}{8} = \frac{304}{8} = \\
 & 12 \text{ inches, the height of the box;} \quad 12 \times 2 = 24 \text{ inches, the width of the box;} \\
 & 24 \times 2 = 48 \text{ inches, the length of the box;} \quad 12 - 5 = 7; \quad 24 - 7 = 19; \quad 48 - 5 = 43; \quad 7 \times 19 \\
 & \times 43 = 5719 \text{ cubic inches, Ans.}
 \end{aligned}$$



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I. MENTAL ARITHMETIC.

This book, as its title indicates, is strictly *mental*, and designed for children; and while it is sufficiently simple and easy for "beginners," it advances with gradual steps till it presents to the learner all the Tables in simple and compound numbers, and many ingenious and practical questions under them, and also several sections in simple fractions, the whole being admirably adapted to the capacities of young scholars, and to prepare them for the next book of the series.

II. INTRODUCTION TO THE NATIONAL ARITHMETIC.

This book consists of mental and written Arithmetic, "on the INDUCTIVE SYSTEM, combining the ANALYTIC AND SYNTHETIC METHODS."

The present edition has been thoroughly revised and entirely re-written, and nearly 150 pages of new matter have been added. The following are some of the prominent features of this work.

1. The arrangement is strictly progressive and philosophical, no principle being *anticipated*.
2. The language is simple, precise, and accurate, rendering the rules, definitions, and illustrations, intelligible to the pupil.
3. The examples are eminently *practical*, and adapted not only to illustrate and fix in the mind the principles which they involve, but also to interest the pupil, exercise his ingenuity, and inspire a love for the science.
4. The *reasons* for the operations have been shown, and the learner is led to look into the philosophy of the subject, rather than perform mechanically operations which he does not understand.
5. The subject of Cancellation is more fully treated, it is believed,

GREENLEAF'S SERIES OF ARITHMETICS.

than in any other work of the kind. The principles upon which it depends, and the different modes of operation are fully developed, and its application and use are made perfectly clear to the scholar.

6. Several subjects not in the former edition, have been added in this; as, Ratio, Duties, Profit and Loss, Factors, Progression, Annuities, &c.; and others, as, Notation and Numeration, Interest, Proportion, Extraction of the Roots, and their application, have been greatly extended and improved, *making the book sufficiently extensive for Common Schools.*

7. Questions have been inserted at the bottom of the pages, designed to direct the attention of teachers and pupils to the most important principles of the science, and fix them in the mind.

III. THE NATIONAL ARITHMETIC.

This book is designed more particularly for advanced scholars in our Public Schools, High Schools, and Academies, and, like the INTRODUCTION, combines the ANALYTIC AND SYNTHETIC METHODS. It was revised in 1847, and contains the most valuable modern improvements.

In describing its prominent characteristics it may be remarked,—

1. That it is a complete system of itself, comprising all the elementary Rules, as well as those pertaining to the higher branches of the science, together with a full illustration and demonstration of their principles, and contains, it is believed, a greater amount and variety of matter strictly arithmetical, than can be found in any other treatise of the kind.

2. It embraces a large amount of mercantile information not usually found in arithmetics, but important to those destined for the warehouse or counting room.

3. The Custom House business, carefully prepared by officers of the Boston Custom House, the Philosophical and Geometrical Problems, the articles on Banking and Exchange, are full, and have passed under the revision of those who are well acquainted with these respective departments.

Of the entire Series of Arithmetics thus briefly described, we have ample testimony from many of the most intelligent School Committees and Teachers in New England and elsewhere, *that it is better adapted than any other before the public, to secure to the pupil MENTAL DISCIPLINE, thorough knowledge of the principles of the science, and facility in their application.*

The great popularity of Greenleaf's Arithmetic is indicated by the fact that it is now in general use in the best schools throughout New England, including the several STATE NORMAL SCHOOLS, in Massachusetts, in New York City, and in hundreds of academies and select schools in various sections of the United States.

Two editions of this Arithmetic, one containing the *answers* in the book, and the other without them, are now published.

COMPLETE KEYS to the INTRODUCTION and NATIONAL ARITHMETICS, containing full solutions and explanations, are prepared for the convenience of teachers only.

Copies of the work will be furnished for examination, on application to the Publisher, ROBERT S. DAVIS, No. 120 Washington Street, BOSTON, or to SANBORN & CARTER, Exchange Street, PORTLAND.

RECOMMENDATIONS OF GREENLEAF'S ARITHMETIC.

The attention of Teachers and Superintendents of Schools, is respectively invited to this popular system of Arithmetic, which is well adapted to all classes of students.

~~15~~ Copies of the work furnished for examination, on application to the Publisher.

To those who have not had an opportunity to examine the work, the following testimonials from eminent teachers, indicating some of its peculiar excellences, are submitted:

PHILLIPS ACADEMY, Andover, May 15, 1846.

Your "National Arithmetic" has been used as a text book in this Institution for several years. We had previously made trial of several different systems, and the comparison has satisfied us that your work possesses decided advantages over all others now in use.

One of the peculiar excellences of your book is, that the examples are so constructed and diversified as to exhaust the subject. It would be almost impossible for a pupil to perform your examples in course, and remain ignorant of any of the important principles of the science. Your work is also happily adapted to accomplish a still higher and more important object, —mental discipline. There are various other points to which I might allude, as the originality of your examples, their practical character, &c.; but the crowning excellence of your system is, that it works well in the school-room.

We have used your "Introductory Arithmetic" in our preparatory department for the last two years, and find it to possess substantially the same valuable qualities that characterize the larger work.

W. H. WELLS,

B. Greenleaf, Esq.

Instructor in English Department.

From Marshall Conant, Esq., Principal of Framingham Academy, —formerly a Teacher in one of the Public Schools, Boston.

After giving Greenleaf's Arithmetic and Introduction a pretty thorough examination, I concluded to give them a trial; and it has been attended with success. The definitions and rules, both in the National Arithmetic and Introduction, are stated with admirable clearness. A feature of these works, which pleases me much, is the selection of such examples as fully illustrate the principles, and teach a skilful application of the rules of arithmetic. The "Mental Arithmetic" by the same author, is well arranged and perspicuous, and goes so far as to prepare the pupil to enter with ease the next work of the series. I particularly like the tables, and the application of them in the latter part of the book. In publishing all the works of this author, I feel that you are doing good service to the cause of education.

Framingham, July 3, 1845.

MARSHALL CONANT.

The Mental, Introductory, and National Arithmetics, by Mr. Greenleaf, have been for some time used in the school under my charge; so that, from experience I can speak freely of their merits. The rules are given in clear and precise language; illustrated where necessary by examples; and furnished with so many questions, skilfully varied, as to render it impossible for any one, after fairly going through the series, to be without a competent knowledge of the subject.

These observations apply particularly to the National Arithmetic. Its efficiency is acknowledged wherever it has been used. During the last six years I have had scholars in every stage of progress, and I have invariably found that it furnished all the information which they desired, while by its systematic arrangement the principles of the science were acquired with pleasure and facility. It is superior, in my opinion, to any work now before the public.

JAMES B. BATCHELLEE,
Principal of Centre School.

Marblehead, April 11, 1846.

After a careful examination of Greenleaf's Arithmetic, and comparing it with a library of Arithmetics which I am fortunate enough to possess, I am prepared to say, that as a practical and scientific work, it is the best I have seen; and I can but regard it only as a valuable acquisition to this department of education. The peculiar excellences of the work, consist in the clearness of its arrangement and the omission of a mass of explanation, tending to confuse the pupil, and to defeat what I regard as one great object of education, *the learning of the young to think*. It is a work which should be introduced into all our schools, and I am persuaded that when its merits become known, it will supersede many works of more extensive circulation, but of far less merit. Having felt that an arithmetic prepared for the higher schools, and at the same time adapted to the comprehension of very young pupils, was a great desideratum, I have for a long time desired to see such a work as this which I have now in use in my school.

MOSES WOOLSON,

Bangor, Me., June 15th, 1844.

Principal of the Female High School.

RECOMMENDATIONS OF GREENLEAF'S ARITHMETIC.

After a trial of several months, Greenleaf's Arithmetics have been adopted as text-books for the classes in my department of instruction. The general arrangement of the introduction of several of the old modes of working problems omitted by so many of the present time, the numerous examples, the clearness and perspicuity of the rules, and the placing of the answers with the sums, are among the advantages possessed by those works, which in my view justly entitle them to preference.

New York, January 24, 1844. WM. TAYLOR A. M.,
Instructor in Natural Philosophy and Mathematics, Washington Institute.

Having had occasion to examine the several treatises upon Arithmetic used in our best schools, and to select from them one for the use of the pupils of the Commercial Department of the University Grammar School, I found Emerson's 3d part and Greenleaf's National Arithmetic to possess apparently about equal degrees of merit. After having taken several large classes through Emerson's, and several others through Greenleaf's, I have adopted the latter as the permanent arithmetic of my school.

ISAAC G. HUBBS, *Commercial and Collegiate School.*

New York, April 9, 1844.

After a careful and rigid examination of Greenleaf's Arithmetic, I do not hesitate to say that it is the *very best* work of the kind extant. I have introduced it into my school, and am delighted with the apparent satisfaction displayed by my pupils.

W. KING, *Classical and English School, 639 Broadway.*

New York, October 2, 1843.

I have carefully examined Greenleaf's Introduction and National Arithmetic. They are, in my opinion, better adapted to the purposes of teaching than any other books in this department of science with which I am acquainted. I prefer them to Emerson's series, which I have used during the last eight years, and I have therefore introduced them into my school. CHAS. W. FARRIS, 649 Broadway, N. Y.

New York, October 4, 1843.

Classical and English School.

I have examined with great care and attention "Greenleaf's National Arithmetic," and have no hesitation in saying, that I think it excels every other work of the kind with which I am acquainted. I have accordingly introduced it into "All Saints' Parochial School," and most cheerfully recommend it to others of my profession.

WM. A. TAYLOR, *Principal of All Saints' Parochial School.*

New York, October 31, 1843.

R. Greenleaf, Esq. Dear Sir: I thank you most heartily for the "National Arithmetic" you presented me some time ago. After a thorough and practical examination of the work, I can truly say it pleases me more than any I have ever used. The youngest scholars are interested, and love to study it; the oldest give evidence of a clearer and better understanding of the subject than they have ever shown before. Having introduced it into my own school, I would cheerfully recommend it to others.

Yours very truly, JOHN JAY GREENOUGH.

New York, September 12, 1843.

I have not only examined Greenleaf's National Arithmetic faithfully, but I have tested its value by use; and I do unhesitatingly pronounce it the best text-book of the kind, that has fallen under my notice, during my entire school-room experience. I shall, hereafter, use no other.

JOSEPH McKEE,

*Classical and English Teacher, Madame Chagarey's School.
Union Square, New York, July, 1844.*

An attentive examination of Greenleaf's National Arithmetic and the Introduction thereto, has confirmed the favorable opinion I had previously formed from report. The rules, simply yet accurately expressed, the lucid illustrations and copious examples, in fact, the entire arrangement, show them to be works of no ordinary merit, and indicate that they have been prepared by one who is a complete master of the science. I have not the slightest hesitation in giving them a decided preference to any works of the kind I have hitherto seen.

M. J. O'DONNELL, *Principal of Public School, No. 11.*

New York, November 22, 1844.

I have examined, with some care, Mr. Greenleaf's Arithmetic, and, by that examination, imperfect as it was, am forced to the conclusion, that on several accounts, it is preferable to most, if not all other works on that subject, that I have seen.

JAMES N. McELIGOTT, *Principal of the Mechanic Society School.*

New York, January, 1844.

RECOMMENDATIONS OF GREENLEAF'S ARITHMETIC.

GREENLEAF'S NATIONAL ARITHMETIC is now used as a text-book in the following important seminaries of learning, among others, which fact may be considered a high recommendation for the work.

☞ The several STATE NORMAL SCHOOLS in Massachusetts, under the direction of the State Board of Education.

The *Normal Schools* in New York City; Rutger's Female Institute, New York; Brooklyn (N. Y.) Female Academy; Abbott Female Academy, and Phillips Academy, Andover; Chauncy Hall School, Boston; Bradford Female Seminary, (Mass.) Miss Hasseltine, Principal; Phillips Academy, Exeter; the Young Ladies' Institute, Pittsfield; Williams Academy, Stockbridge; Worcester County High School, Worcester; Catholic College, Worcester; Wesleyan Academy, Wilbraham; Amherst Academy; Quabaoag Seminary, Warren; Framingham Academy; Hingham Academy; Portland Academy; Peirce Academy, Middleborough; Partridge Academy, Duxbury; Lowell Academy; Bristol Academy, Taunton; New Bedford Academy; Rev. D. Leach's Select School, Roxbury; Putnam High School, Newburyport; Friends' Academy, Providence; Kimball Union Academy, Meriden, (N. H.); Pembroke Academy; New Hampton Academy; Keene Academy; Hillsboro' Academy; Mount Caesar Seminary; Belfast Academy; Thetford Academy; Caledonia County Grammar School; the High Schools or Academies in Woodstock, Middlebury, Rutland, Montpelier, Burlington, Bradford, and many other towns in Vt.; the High Schools in Hallowell, Augusta, Waterville and Bangor, and many other distinguished institutions in various parts of the United States; and wherever the work has been introduced, *it is still used with great success*, — which is deemed a sufficient recommendation.

The whole or a part of this series, has been recommended and adopted by the superintending school committees of the principal towns throughout New England, including Andover, Haverhill, Newburyport, Salem, Beverly, Lynn, Portsmouth, Worcester, Springfield, Northampton, Pittsfield, Taunton, Fall River, Pawtucket, Bristol, Marblehead, Duxbury, Kingston, Plymouth, Weymouth, Hingham, Milton, Barnstable, Ipswich, Danvers, Brookline, Newton, Watertown, Medford, Quincy, Dedham, Nashua, Manchester, Concord, Fitzwilliam, Keene, Portland, Bangor, Belfast, Hallowell, Augusta, Waterville, Hartford, Norwich, and in the best public and private schools in various sections of the United States.

GREENLEAF'S ARITHMETICS are used in most of the Select Schools and Academies (including the following) in New York City, which are of the first grade.

Washington Institute,	T. D. & T. W. Porter, Principals.
Rutger's Female Institute,	Charles E. West, Principal.
Cornelius Institute,	Rev. J. J. Owen,
All Saints' Parochial School,	Wm. A. Taylor,
Commercial and Collegiate School,	Hubbs & Clarke,
Classical, Mathematical, and Com'l Institutions,	H. Peugnet,
Classical and English School,	Isaac F. Bragg,
Classical and English School,	Charles Lyon,
New York Institute,	E. H. Jenny,
Trinity School,	William Morris,
Boarding and Day School for Young Ladies,	Madame Chegaray,
Mechanics' Institute School,	Mr. Tracy,
English and Classical School,	Aaron Rand,
Classical, Mathematical, and English Academy,	J. F. Worth,
Select School for Boys,	J. J. Greenough,
Classical, French, and English School,	Taylor & Foignet,
Scotch Presbyterian School,	Robert H. Browne,
City Commercial School,	J. B. Quick,
Academy for Young Gentlemen,	E. L. Avery,
Commercial and Collegiate Institute,	J. Fanning & H. Cady,
St. Luke's School,	George A. Rogers,
Female Academy,	Mrs. Page,
Classical and English School,	James Lawson,
Brooklyn Female Academy,	A. Crittenden,
Select School for Young Ladies, (Brooklyn,)	A. Greenleaf,
Collegiate and Commercial School, (Brooklyn,)	James G. Russell,
Brooklyn Grammar School,	Walter Chisholm,

☞ This system of Arithmetic is also the text book in the "Normal Schools" (male and female,) under the supervision of the Public School Society, and in the Ward Schools in the City of New York, and in various parts of the State.

NEW ELOCUTIONARY WORKS,

PUBLISHED BY

ROBERT S. DAVIS, BOSTON.

THE PRACTICAL ELOCUTIONIST. FOURTH EDITION.

THE NATIONAL SPEAKER. FOURTH ED. 12mo. pp. 324.

Since the first edition of the above works was issued, a few months ago, they have met with a very favorable reception, and one or both have been adopted as text-books by School Committees or teachers in Roxbury, Cambridge, Charlestown, Salem, Lowell, Springfield, and in several other important places.

RECOMMENDATIONS.

From Rev. Thomas Hill, A. M., Member of the School Committee, Waltham, Mass.

As I looked over the "Practical Elocutionist" of Mr. Maglathlin, I found my old Whateleian prejudices against rules for utterance vanish. The practical, intelligible, and valuable nature of the rules in this little book makes it the only thing I have ever seen which I thought would help either teacher or scholar in our common schools in learning to read well.

From Levi Reed, Principal of the Washington School, Roxbury, Mass., and President of the Norfolk County Teachers' Association.

I have examined "The Practical Elocutionist" with much satisfaction, and am happy to say that I like its plan and matter. A brief manual of vocal culture, like this, has been much needed, and I have no doubt, that, in the hands of a skilful teacher, it may be used with the happiest results.

From C. C. Chase, A. M., Principal of the High School, Lowell, Mass.

I know of no work on the subject of Elocution which I can more highly recommend than "The Practical Elocutionist."

From W. B. Wait, Principal, and H. A. H. Wait, Preceptress, of Melrose Academy, near Boston, Mass.

"The Practical Elocutionist" is, as it should be, brief; but being, throughout, definite, lucid, and thoroughly practical, it is abundantly full and comprehensive. It seems to us exactly adapted to supply our public schools and academies with what many excellent teachers have hitherto regarded as a great desideratum. Having introduced it into the institution under our charge, and had opportunity to test its merits by actual use, we are prepared to give the work our highest commendation.

RECOMMENDATIONS.

From EDWIN W. BARTLETT, A. M., Principal of the High School, Woburn, Mass.

Having carefully examined "The National Speaker," I am happy to state, that it appears to me most admirably adapted to the purposes intended. The different parts of the work are well arranged, and the selections show that they have been very judiciously made.

The elocutionary analysis is evidently the result of much labor, being concise, definite, and clear. It seems to contain all the necessary rules for good reading and speaking, illustrated by most appropriate examples. In short, I am much pleased with the whole work.

From FRANKLIN CROSBY, A. M., Principal of the High School, South Reading, Mass.

The arrangements and selections of "The National Speaker" are such as to commend it to all who are interested in elocution as a branch of school studies.

An "Elocutionary Analysis" is certainly a new feature in an American compilation. In my opinion, the selections are admirably adapted to insure that variety so necessary in a work of this nature. While a few of the most legible of the ancient landmarks are allowed to remain, I am glad to see that a desire for a change imparts to this book that freshness of matter so essential to success.

From J. PEARL, A. M., Principal of the College Street Female Seminary, New Haven, Ct.

I have examined with much pleasure "The National Speaker," and am pleased with the arrangement, and the selection of its pieces; I think the elocutionary analysis better adapted to promote correct enunciation and articulation than any work of the kind with which I am acquainted.

From CHARLES R. COBURN, Esq., President of the New York State Teachers' Association, and Teacher in Oswego Academy, N. Y.

Mr. Henry B. Maglathlin, — Sir, I am highly pleased with your works on elocution. They seem to be just such books as are required by every person who is engaged in teaching the elements of good reading and speaking.

The "Elocutionist" contains what its title indicates, "the principles of elocution rendered easy and comprehensive," and is eminently practical. Notwithstanding its brevity, I think it sufficiently full.

"The National Speaker" is well arranged, and the selections, which embrace a suitable variety of style, are judiciously made; the most of them being taken from late eminent writers and speakers in Europe and America.

From GEORGE SPENCER, A. M., Author of Latin Lessons, and Principal of Utica Academy, N. Y.

I have examined "The National Speaker" with some care, and am pleased with it. Its "principles of elocution" are such as are sanctioned by nature and the most correct usage, and are expressed in clear and simple language. It will fully meet the want I have felt of a similar work for my classes in this branch of study.

Robert S. Davis' Publications.

LEVERETT'S CÆSAR AND FOLSOM'S CICERO.

LEVERETT'S CÆSAR'S COMMENTARIES. Caii Julii Cæsaris Commentariorum de Bello Gallico ad Codices Parisinos recensit, a N. L. Achaintre et N. E. Lemaire. Accesserunt Notulae Anglicæ, atque Index Historicus et Geographicus. Curavit F. P. LEVERETT. Editio stereotypa.

From John J. Owen, Principal of Cornelius Institute, New York, and Editor of Xenophon's Anabasis.

I have examined with some attention Cæsar's Commentaries, edited by Leverett, and Cicero's Orations, edited by Folsom, and am happy to recommend them to classical teachers, as being, in my estimation, far superior to any other editions of those works, to which students in this country have general access. The typography is fair and accurate, and the general appearance of the books does honor to the enterprising publisher. I hope these editions will be extensively used in our Academies and High Schools.

(Signed) JOHN J. OWEN, *Cornelius Institute.*

New York, Nov. 22, 1843.

I have attentively perused Leverett's Cæsar. The neatness and accuracy of the Text, and the beautiful adaptation of the Notes, compel me to use it in preference to any other that I have seen.

(Signed) E. H. JENNY, *Principal of New York Institute.*
New York, Nov. 1, 1843.

FOLSON'S CICERO'S ORATIONS. M. T. Ciceronis Orationes Quædam Selectæ, Notis illustrate. [By CHARLES FOLSOM, A. M.] In Usum Academico Exoniensis. Editio stereotypa, Tabulis Analyticis instructa.

From Charles E. West, Principal of Rutgers Female Institute, New York.

I take pleasure in commanding to teachers the recent beautiful edition of Folsom's Cicero. The attractiveness of its text, notes, synoptical and analytical tables, and typographical execution, led me to place it in the hands of a class of young ladies, who are reading it with delight.

(Signed) CHARLES E. WEST, *Principal of R. F. I.*
New York, Nov. 1, 1843.

I have examined Cicero's Orations, edited by Charles Folsom, and prefer it to any other I have seen. The Synopsis and Analysis of each Oration are so beautifully given, that it seems as a Rhetoric, as well as a Text Book for learning Latin. I shall use it exclusively in the institution under my charge.

(Signed) E. H. JENNY, *Principal of New York Institute.*
New York, Nov. 1, 1843.

I have carefully examined the recent editions of Leverett's Cæsar, and Folsom's Cicero, and fully concur in the opinions above expressed.

(Signed) WM. A. TAYLOR, *Principal of All Saints Parochial School*
New York, Nov. 1843.

These editions of Cæsar and Cicero are highly recommended by the following Teachers, who have recently adopted them, in preference to all others.

ISAAC F. BRAGG, *Principal of Male High School,* New York.
C. TRACY, " " English and Classical School, "
B. F. PARSONS, " " Female Classical School, "
W. MARSH, " " Classical and English School, Lyceum, Brooklyn.

Robert S. Davis' Publications.

FISK'S GREEK GRAMMAR, AND EXERCISES.

A GRAMMAR OF THE GREEK LANGUAGE, by BENJAMIN FRANKLIN FISK. Twenty-sixth stereotype edition.

The requisites in a Manual of Grammar, are simplicity and lucidness of arrangement, condensation of thought, and accuracy of principle and expression. These requisites Mr. Fisk appears to have attained in a considerable degree in his Greek Grammar, of which we have expressed approbation by introducing it into our School.

FORREST AND WYCKOFF, *Principals of Collegiate School, New York City.*
New York, October 3d, 1843.

I have used for several years Fisk's Greek Grammar, and I regard it among the best, and perhaps the best, now used in our Schools. Pupils instructed in it, encounter less difficulty than in others. E. H. JENNY, A. M.,

New York, October, 1843. Principal of "New York Institute."

Mr. R. S. Davis, — I have examined Fisk's Greek Grammar, published by yourself. To all who will take the trouble to examine it, its own intrinsic merit will be its best recommendation. The Syntax I regard as decidedly superior. The rules are peculiarly clear and comprehensive, thereby relieving the student from a heavy tax upon his time and memory, to which he would otherwise be subjected, and from which, perhaps, he is not equally free in the use of any other work of the kind.

C. TRACY, *Principal of Select English and Classical School.*
New York City, October 28th, 1843.

From Benjamin Greenleaf, Esq., author of the *National Arithmetic, etc.* Bradford, (Mass.,) Teacher's Seminary, October 16th, 1843. — For several years past, I have used Fisk's Greek Grammar in my seminary. I consider it a work of superior merit. It is well arranged; and the rules are clear and perspicuous. It is, in my opinion, better adapted to initiate pupils into the idiom of the Greek language, than any other treatise of the kind, that I have examined. FISK'S GREEK EXERCISES should be used in connexion with the Grammar. A work of this kind has long been needed. It is a production of great merit.

You respectfully, BENJAMIN GREENLEAF.

Recommendations fully concurring with the above opinions, have been received from the following gentlemen, among many others, who have recently adopted this Grammar in preference to any other.

ISAAC F. BRAGG, *Principal of Male High School,* New York.
JAMES N. MCCELLIGOTT, " " *Mechanics' Society School,* " "
WM. A. TAYLOR, " " *All Saints Parochial School,* " "
MOORE AND FISH, " " *the New England School,* " "
CHARLES W. FEeks, " " *Classical and English School,* " "
WASHINGTON KING, " " " " " "
J. JAY GREENOUGH, " " *Select School,* "

[T] Fisk's Greek Grammar is used in Harvard University, and in many other Collegiate and Academic Institutions, in various parts of the United States.

FISK'S GREEK EXERCISES. Greek Exercises; containing the substance of the Greek Syntax, illustrated by Passages from the best Greek Authors, to be written out from the words given in their simplest form; by BENJAMIN FRANKLIN FISK. "Consuetudo et exercitatio facilitatem maxime parit." — Quintil. Adapted to the Author's "Greek Grammar." Sixteenth stereotype edition. Fisk's Greek Exercises are well adapted to illustrate the rules of the Grammar, and constitute a very useful accompaniment thereto.

(Signed) J. B. KIDDER, *Teacher of Select School, New York.*

Robert S. Davis' Publications.

SMITH'S CLASS BOOK OF ANATOMY.

THE CLASS BOOK OF ANATOMY, explanatory of the first principles of Human Organization, as the basis of Physical Education; with numerous Illustrations, a full Glossary, or explanation of technical terms, and practical Questions at the bottom of the page. By J. V. C. Smith, M. D., formerly Professor of General Anatomy and Physiology in the Berkshire Medical Institution. Seventh Improved Stereotype Edition.

This work has received the highest testimonials of approbation from the most respectable sources, and has already been adopted as a text book in many schools and colleges in various sections of the United States.

The estimation in which it is held in other countries may be inferred from the fact, that a translation of it has recently been made into the Italian language, at Palermo, under the supervision of the celebrated Dr. Placido Portel. It is also in the progress of translation into the Hawaiian language, by the American missionaries at the Sandwich Islands, to be used in the higher schools, among the natives; and the plates are soon to be forwarded, with reference to that object, by the American Board of Commissioners for Foreign Missions; which furnishes conclusive evidence of its value and utility.

*From Rev. Hubbard Winslow, Pastor of Bowdoin St. Church, Boston.
Boston, Nov. 7, 1836.*

I have examined the Class Book of Anatomy, by Dr. Smith, with very great satisfaction. For comprehensiveness, precision, and philosophical arrangement, it is surpassed by no book of the kind which I have ever seen. The study of Anatomy and Physiology, to some extent, is exceedingly interesting and useful as a branch of common education; and it is to be desired that it should be more extensively adopted in all our higher schools. To secure this end, there is no other book before the public so well prepared as the one under remark. It is also a convenient compend to lie upon the table of the scientific anatomist and physician, and a very valuable family book for reference, and for explanation of terms which often occur in reading.

H. WINSLOW.

We are gratified to see the attempt to introduce a new subject to ordinary students. It is wonderful that civilized man has been so long willing to remain ignorant of the residence of his mind, and the instruments by which it operates. The book before us abounds in information in which every adult reader will feel a deep interest, and from which all may derive valuable lessons of a practical kind. We are gratified to see frequent references to the Great First Cause of life and motion. We cordially wish success to his enterprise in a path almost untrodden.—*American Annals of Education.*

Copy of a Communication from Mr. C. H. Allen, of the Franklin Academy, Andover, Mass.

North Andover, Dec. 10, 1836.

Mr. R. S. Davis. Dear Sir: During my vacation, I have had time to examine Smith's Class Book of Anatomy, the second edition of which you have recently published. I do not hesitate to speak of it as the very work which the public have long demanded. It contains knowledge which should be widely diffused. The author is remarkably clear in his explanations and descriptions, and very systematic in his arrangement. So that he has rendered this neglected branch of useful knowledge highly interesting to all classes.

Yours, respectfully, CHAS. H. ALLEN.

Robert S. Davis' Publications.

WALKER'S SCHOOL DICTIONARY AND THE CLASSICAL READER.

WALKER'S BOSTON SCHOOL DICTIONARY. Walker's Critical Pronouncing Dictionary, and Expositor of the English Language. Abridged for the use of Schools throughout the United States. To which is annexed, an Abridgment of WALKER'S KEY to the pronunciation of Greek, Latin and Scripture Proper Names. Boston stereotype edition.

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This work is highly approved, as a *First Class Reader*, and has received many commendable notices from Public Journals throughout the United States, from which the following are selected.

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This work is a valuable acquisition to our schools. It is a work purely national and modern. It has many valuable historical facts and anecdotes in relation to the early history, the character, manners, geography and scenery of our country. In the matter it contains, it is well adapted to the taste, feelings, and habits of the present age. It embodies many of the brightest and most sparkling gems of Irving, Webster, Everett, Jefferson, Channing, Sparks, Bryant, Percival, &c.

From the American Journal of Education.

We are happy to see another valuable addition to the list of reading books,—one which has been compiled with a strict regard to the tendency of the pieces it contains, and which bears the stamp of so high a standard of literary taste. In these respects the Classical Reader is highly creditable to its editors.

Extract from the North American Review.

The Classical Reader is selected from the very best authors, and the quantity from each, or the number of pieces of a similar character, by different authors, affords all that can be required for classes, and in sufficient variety, too, of manner, to facilitate greatly the formation of correct habits of reading, and a good taste. From each of those considerations, we give it our cordial recommendation.

The Publisher respectfully solicits the attention of Teachers, School Committees, and all interested in the cause of Education, to the foregoing list of School Books,—feeling confident that an examination of the works will lead to a conviction of their merits,—copies of which will be furnished for this purpose, with a view to their adoption, without charge.

PARKER'S EXERCISES IN COMPOSITION.

The great popularity of this work has given it an introduction into almost every Academy and higher Seminary throughout the United States, England, and the British Provinces; and its usefulness, as an aid in teaching this important branch of education, has been acknowledged by hundreds of eminent teachers who have used it.

The School Committee of Boston authorized its introduction into the public schools of the city, soon after the first edition was issued, and it is now the only work on Composition used in them.

The publisher trusts that the improvements contained in the present edition will render the work more acceptable, and give it a still wider circulation.

The following RECOMMENDATIONS have been selected from a large number of valuable notices from the most respectable sources:

From J. W. Bulkley, Esq., Teacher, Albany.

I have examined "Parker's Exercises in Composition," and am delighted with the work. I have often felt the want of just that kind of aid that is here afforded. The use of this book will diminish the labor of the teacher, and facilitate the progress of the pupil in a study that has hitherto been attended with many trials to the teacher, and perplexities to the learner.

If Mr. Parker has not strewed the path of the student with smooth stones, he has "removed many stumbling-blocks out of the way, made crooked things straight, and rough places smooth." It is certainly one of the happiest efforts that I have ever seen in this department of letters,—affording to the student a forcible introduction to the most important principles and rules of rhetoric; and I would add, that if carefully studied, it will afford a "sure guide" to written composition. I shall use my influence to secure its introduction to all our schools.

From Rev. Samuel P. Newman, Professor of Rhetoric in Bowdoin College.

I have examined "Progressive Exercises in English Composition," by R. G. Parker, with much care, and hesitate not to express an opinion that it is well adapted to the purpose for which it is designed. It is well fitted to call into exercise the ingenuity of the pupil, to acquaint him with the more important principles and rules of rhetoric, and to guide and aid his first attempts in the difficult work of composition.

From Walter R. Johnson, Esq., Franklin Institute, Philadelphia.

Having often felt the necessity of reducing to its simple elements the art of composition, and having been compelled, from the want of regular treatises, to employ graduated exercises expressly prepared for the purpose, and similar in many respects to those contained in this treatise, I can speak with confidence of their utility, and do not hesitate to recommend them to the attention of teachers.

From Dr. Fox, Principal of the Boylston School, Boston.

This little manual, by the simplicity of its arrangement, is calculated to destroy the repugnance, and to remove the obstacles, which exist in the minds of young scholars to performing the task of composition. I think this work will be found a valuable auxiliary to facilitate the progress of the scholar, and lighten the labor of the teacher.

From Mr. C. Walker, Principal of the Eliot School Boston.

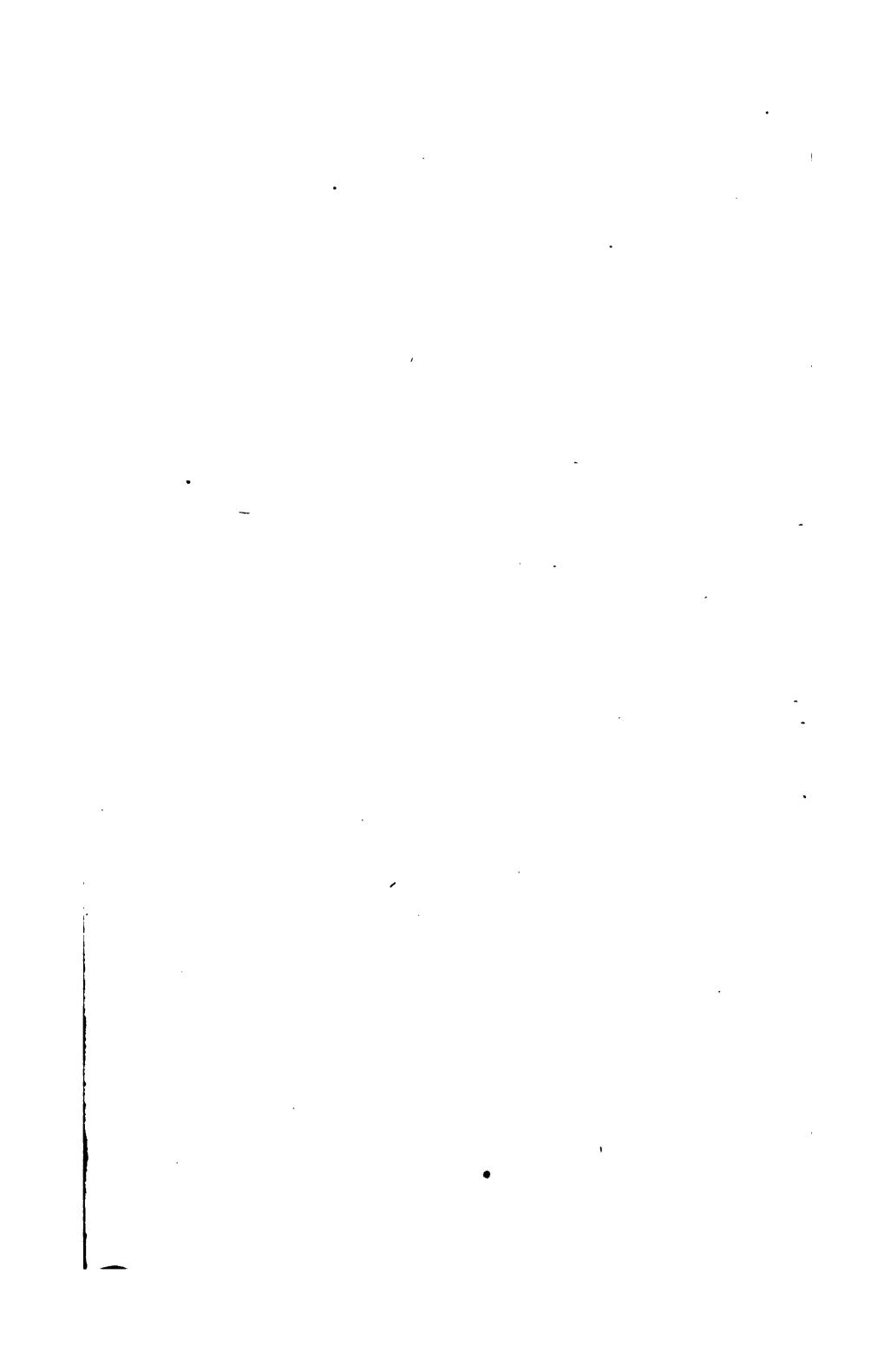
This work is evidently the production of a thorough and practical teacher, and in my opinion it does the author much credit. By such a work, all the difficulties and discouragements which the pupil has to encounter, in his first attempts to write, are in a great measure removed; and he is led on progressively, in a methodical and philosophical manner, till he can express his ideas on any subject which circumstances or occasion may require, not only with sufficient distinctness and accuracy, but even with elegance and propriety. An elementary treatise on composition, like the one before me, is certainly much wanted at the present day. I think this work will have an extensive circulation; and I hope the time is not distant, when this branch of education, hitherto much neglected, will receive that attention which in some degree its importance demands.

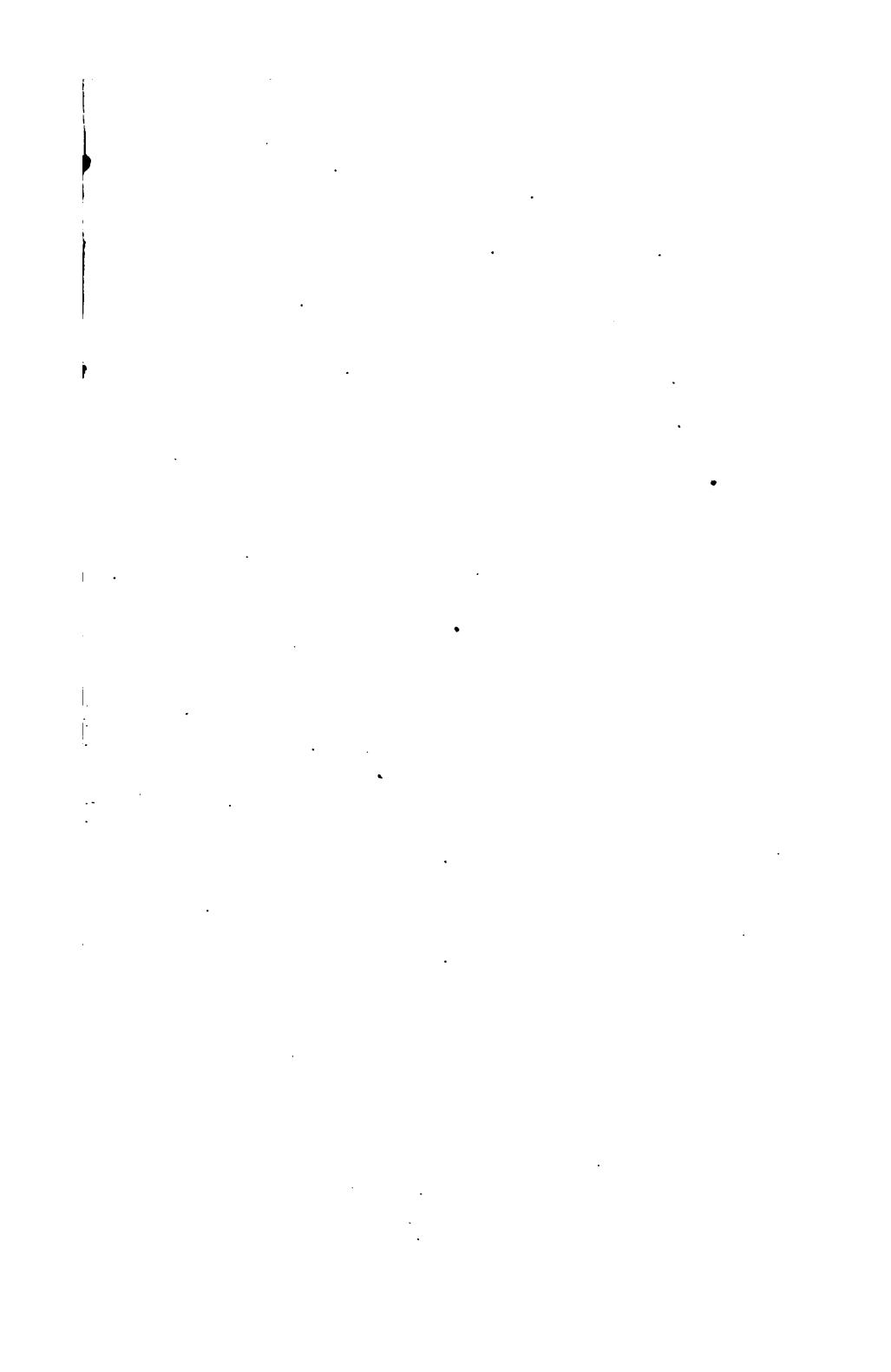
We have seen no work which seems to us so useful as a guide to the teacher, and an aid to the pupil. — *American Annals of Education and Instruction.*

The design of this work is unexceptionably good. By a series of progressive exercises, the scholar is conducted from the formation of easy sentences to the more difficult and complex arrangement of words and ideas. He is, step by step, initiated into the rhetorical propriety of the language, and furnished with directions and models for analyzing, classifying, and writing down his thoughts in a distinct and comprehensive manner. — *London Journal of Education.*

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